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**THE TREND TO STANDARDIZATION
PRODUCT DEVELOPMENT IN THE BRITISH MOTOR CYCLE INDUSTRY
1896-1916**

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Thesis submitted for the degree of PhD

**THE CITY UNIVERSITY
BUSINESS SCHOOL**

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ABSTRACT :

The thesis is a historical study of the first twenty years of the British motor cycle industry in terms of the development of its product.

The main theoretical issue is standardization, not in its usual sense as a formal activity aimed at the setting up of standards, but as a trend the effect of which is for products to become more and more alike across the industry as a whole. Standardization in this sense is to a large extent an unintended consequence of the wish on the part of producers to design products which operate more efficiently, which can be produced more cheaply, and which have the widest possible appeal in the marketplace; and of the preference, on the part of the majority of consumers, for products which are familiar and of known reputation and performance, as against those which are new and untried.

The trend to standardization is analysed into its main components, functional efficiency, production efficiency, and marketing efficiency, and these are used as the basis of a number of propositions which make it possible to consider in more depth the development of the product during the three phases of industry development: experimental, developmental, and standardization.

The more substantive chapters of the thesis are organized around three main themes, the development of the industry as a whole, and the development of the product from a technical point of view, and from a consumer point of view.

The main conclusion is that the development of its product into a standard form—one on which newcomers to the industry can base their own products and which consumers can recognise as reliable and worthy of purchase—is the most critical stage in the development and consolidation of a new industry.

ABBREVIATIONS

BHD	Mr., later the Rev., Basil H. Davies, also known as "Ixion"
FES	functional efficiency standardization
H & W	Hilderbrand & Wolfmüller
hp	horse power (a nominal rating in this case)
kph	kilometres per hour
MES	marketing efficiency standardization
mph	miles per hour
mov	mechanically-operated inlet valve
PES	production efficiency standardization
rpm	revolutions per minute
TT	The Isle of Man Tourist Trophy Races

CHAPTER 1

INTRODUCTION

Much interest was generated in the British motor cycle industry when it was supplanted by relative newcomers to motor cycle manufacture, the Japanese, during the 1960s and early 1970s. The British industry, still world leaders in 1960 and suppliers of by far the greater part of the world trade in motor cycles, had declined to virtual extinction in little more than ten years. This was a major disaster for British industry. Why had it happened?

A review of several studies in which particular attention was given to this question produced several reasons ranging from the inadequacies of the British industry in terms of poor leadership by top management,¹ out-of-date production methods,² and the lack of forward product planning,³ to the particular advantages of the Japanese industry such as a large home market and financial support.⁴

While explanations of this nature can be convincing, they are usually unsatisfactory when they are intended to account for a major historical event because they tend to concentrate on more immediate issues. There was, however, no serious study of the history of the British motor cycle industry to provide the longer-term perspective. This was partially remedied, if only to a rather limited extent, by the popular histories of motorcycling which, although not primarily concerned with the industry, did offer a few clues to its decline.

Among these was the fact that in 1960 almost all the firms in the industry were offering products of rather conventional design with little variation.⁵ But British motor cycles had not always been so dull and conventional. In earlier days and particularly in the earliest days of the industry, there had been a great variety of product design and a relatively high degree of innovation.

It was from these observations that the present research developed. There was clearly a need for a more rigorous historical study of the British motor cycle industry than was offered in any of the popular histories of motorcycling. Such a study would focus on the tendency for the innovative and rather diverse product make-up of the industry in earlier days to evolve into one that was relatively standardized and conventional.

Further investigation revealed that this tendency was not a recent development but was apparent well before the first world war,⁶ which suggested that the earliest period of the industry's history would be one of the most interesting to study since it was a time when the most profound changes were taking place. It was decided therefore to concentrate on the first twenty years, particularly as it would have been difficult to write the complete history of the industry within the time-scale of a PhD.

The thesis thus became a study of product development in the first twenty years of the British motor cycle industry, with emphasis on the relationship between product innovation and standardization. The main problem of the research was to explain how the relatively diverse and innovative product make-up of the industry in its earliest days had first begun to evolve into one that was rather more standardized and conventional. The research would also be concerned with innovation and the circumstances under which more innovative products would be accepted or rejected. These topics would indicate the direction the research should take but would in no way detract from it as a history, and in fact they would be very much a part of that history.

Data Collection

Research of this nature might be tackled at various levels: the industry itself, the firm, and the consumer, or perhaps all three at the same time. Primary emphasis on the firm proved to be impracticable because of the lack of archive material. Neither did the other approaches look

particularly promising since the data needed to support them seemed to be equally lacking.

At this point the research might well have been abandoned since not only was there no serious historical study of the British motor cycle industry, but there were no usable archives either. Thus there was no previous research on which to build and no obvious source of data. There were many popular histories of particular marques but these were rather like the histories of motorcycling in that they were largely confined to technical data and accounts of sporting events. The only promising source of data turned out to be the journals, the trade and popular press of motorcycling.

A preliminary examination of some early motorcycling journals revealed that they contain a great deal of useful data particularly from the point of view of product development. Not only is there a far more complete account of the technical development of the motor cycle than can be found anywhere else, but also a considerable amount of material relating to the consumer point of view in the form of road tests, accounts of riders' experiences on the road, and readers' letters which are often concerned with personal experiences and current controversies involving technical and other issues. Information about the progress and development of the industry itself is rather less abundant, but what there is is to the point and often of a kind which is almost impossible to find elsewhere.

In adopting this approach to data collection the main deficiency was likely to be the lack of specific information on operations within the firm. Something might be inferred about the nature of a firm from the nature of its product, but there would be little or nothing concerning the actual decision-making processes related to product development. This was less of a disadvantage than it might seem, however, since the main concern was with the industry as a whole and its overall product make-up and there was a reasonable amount of data in this area.

The Theoretical Background

Thus the research was practicable at least from the point of view of data collection, but what of the theoretical background: what kind of conceptual or theoretical base might underpin the research so as to take it beyond the merely empirical?

Given the limitations of the data, there were two approaches which looked promising, starting from either standardization or product development. The literature of product development, as will be seen in Chapter 3, provided some explanation as to why the product make-up of an industry might tend to become increasingly standardized, but offered little or nothing in the nature of theory.

The literature of standardization was at first disappointing since almost everything published appeared to be mainly concerned either with general issues like measurement and mass production, or with the specifications of standards in particular industries. There was nothing at all on standardization as a stage in the development of industries except for one source, Gaillard (1934), whose approach did not prove helpful.⁷ Further material on the development of standardization was found only by searching through the literatures of likely industries and the historical journals, but these sources although useful did not provide anything of a theoretical nature.

The theoretical background to the research came eventually, not from any established concept or theory, but from the observation that standardization is a universal trend: "A little reflection will show that standardization in its broader sense has furnished the base on which nature has created the universe".⁸ Such a far-reaching statement requires examination which would be too big a task for this brief introduction, the reader therefore is referred to Chapter 2 for further discussion. In the same chapter also will be found further support for the concept of a trend to standardization in Darwin's theory of natural selection.

In the light of these ideas, the trend to standardization was defined as the tendency over time for diverse

entities to be formed into classes according to activity, function, or other factors of correspondence, and, within each class, to become more and more alike. It was difficult, however, to find theoretical support for such a concept in studies of industry, because standardization is usually treated as a deliberate, formal process only concerned with setting up standards. In contrast, the trend to standardization is to a large extent independent of intention; it follows, not as a result of deliberate policy but from the day-to-day activities of production, marketing and consumption, and the gains which come from developing and using better products. Thus the present concern is with the tendency of products to become standardized across a whole industry in a way that has little connection with the formal attempt to set up standards.

Empirical Support

Some empirical support was found for the trend in the literatures dealing with research on particular industries.⁹ As will be seen in Chapter 5, the early history of the cycle industry was characterised by a variety of different product designs. The number of these did not begin to diminish until the development of the safety bicycle in 1885. From about 1889 onwards the efforts of product developers were largely confined to improving the standard safety bicycle and other designs were gradually dropped.¹⁰

A similar pattern of development occurred in the motor industry. In the earliest days, modification of existing designs was an almost constant process: "It must, however, be understood that not only have all the original continental motors previously named been subjected to alteration in detail—often of the most radical in character—almost every year since the latter eighties, but also that during that period dozens of new firms have sprung up with still other improvements".¹¹

Thus there was no early standardization: "In 1900 no public standards had yet been developed as to what the automobile ought to look like and how it ought to be

powered".¹² To the contrary there was still great variety of design: "Divers, and sometimes weird and wonderful, were the early motive and transmission systems....."¹³

The first move towards a standard car came earlier than might have been expected, however, through imitation. Early in the 1900s the American company, Locomobile, introduced a four-cylinder water cooled car of French design—"the first direct imitation by an American manufacturer"—and within a year 14.5% of all American-made automobiles were of this type. By 1904, 19.6% were of the same type, and by 1906, 56%.¹⁴

The beginnings of product standardization in the aircraft industry would have taken much longer to achieve if it had not been for military flying. The Royal Flying Corps soon discovered that the "multiplicity of types was burdensome".¹⁵ The solution was sought via a competition to decide which was the best aircraft so as to set in train measures to mass produce it. Unfortunately, the winner was almost impossible to mass produce, and another aircraft was chosen.¹⁶

The first world war increased the need for standardization. In 1916 forty different engines types were under construction; the number was reduced to seven but four of these proved to be failures.¹⁷

In this case product standardization was hurried forward because of particularly pressing circumstances, and it is therefore untypical. It supports the idea of the trend, nevertheless, and what was enforced in war-time would in more normal times almost certainly have happened eventually as a matter of course.

Despite the lack of research in which the trend to standardization or a related issue has been the main point of focus, these studies provide a degree of confirmation that the product make-up of an industry will tend to develop in the way indicated by the concept of a trend. This is no more than we would expect, however, and it is likely that a similar process takes place in most industries. To what extent it is universal is an empirical question, but

there are some fairly obvious cases where it may not apply to any great extent. Among these are industries in which one of the most important characteristics of the product is its exclusiveness, as in the fashion and jewellery trades, and where the product is so large or expensive that it is usually built to the customer's specifications, as in the case of large civil engineering projects. But these are rather special cases and the kind of exceptions which do not really challenge the rule.

The Aims of the Research

The purpose of research is (or should be) to solve problems.¹⁸ The main problem of the research as set out in the earlier part of this chapter, is to explain how the relatively diverse and innovative product make-up of the industry in its earliest days first began to evolve into one that was rather more standardized and conventional. It should be remembered therefore that the following more specific aims are to some extent secondary, or perhaps better described as methological, in that they are supportive of the main drive of the research and have been derived from it, and are to be treated therefore as subordinate to it rather than as ends in themselves. These aims are:

1. Historical: to carry out a first serious study of the early development and growth of the British motor cycle industry. Thus the research fills a gap in our knowledge of what was once a major British industry.

Note the next three aims, conceptual, analytical and integrative, are presented separately for analytical purposes although they do to some extent overlap.

2. Conceptual: to develop a new concept, the trend to standardization, which promises to have a much wider range of usefulness than the idea of standardization, per se, in its usual application.

3. Analytical: to explore and analyse the trend to standardization, and to conceptualize and investigate its components; also to investigate the relationship between

product innovation and standardization and the circumstances in which any tendency towards innovation or standardization either weakens or strengthens.

4. **Integrative:** to merge empirical fact with conceptual analysis with a view to achieving a better understanding of the historical processes at work, and learning something also about the operation of the trend to standardization and product development in a historical setting.

5. **Further research:** to suggest new directions for research particularly in industrial history, standardization and product development.

An Outline of the Research

In Chapters 2 and 3 the trend to standardization is developed further as a concept. It is analysed into three main component parts: functional efficiency standardization (FES), production efficiency standardization (PES), and marketing efficiency standardization (MES).

Each of these is examined with a view to discovering its relationship to the others and its overall significance. FES is discussed largely with reference to engineering design; PES, with reference to historical developments in production technology; and MES, with reference to recent research in product development.

In Chapter 4 the conclusions of the previous two chapters are organized into a series of propositions which are intended to serve as a partial guide to the development of the research on the industry.

The development of the standard product (and by extension, the industry) is divided into three phases: experimental, developmental, and standardization. Some of the propositions are related specifically to these three phases, and the remainder to the industry as a whole and the product in general.

Chapter 5 deals with the development of the bicycle. The motor cycle is based on the bicycle and if there had been no bicycle there would probably have been no motor

cycle. This relationship is reinforced by the fact that the motor cycle industry was parented by the cycle industry.

Chapter 6 discusses the pre-commercial phase of motor cycle development, a period of experimentation covering the years 1869-1893.

Chapter 7 examines at length the first commercial phase, a period when products were still largely experimental covering the years 1894-1900. It is divided into three main sections dealing with industry as a whole, the technical development of the motor cycle and its development as a consumer product. It is concluded with a discussion of the propositions relevant to this chapter formulated in Chapter 4.

Chapter 8 follows broadly the same pattern as Chapter 7. It covers the developmental phase, 1901-1907, when the motor cycle was first developed into a viable and reasonably satisfactory machine from the consumer point of view.

Chapters 9-12, taken as a single unit, follow the same general pattern as Chapters 7 and 8. They deal with the standardization phase, 1908-1916, which covers the first signs of product standardization across the industry as a whole. Chapter 9 traces the history of the industry in general up to the early war years; Chapter 10 examines the standard product and its further development; Chapter 11 considers the effectiveness of the standard product from the consumer point of view; and Chapter 12 presents the conclusions to this section of the research.

Chapter 13 discusses the main findings of the thesis and Chapter 14, while examining the orientation to product development and ways it may have changed during the period, considers whether the trend to standardization evolved into a deliberate policy.

The Research Method

The research method varies from chapter to chapter depending on the subject matter. The methods used include concept development, conceptual analysis, literature search

and review, and factual and statistical data analysis.

The main units of analysis are the industry and the product. Where data allows, individual firms are discussed but mainly for purposes of illustration.

For the purposes of data collection, about one hundred thousand pages of material from the early trade and popular motorcycling press were examined, plus a substantial number of other publications and a small amount of archive material.

Several different areas of literature were studied including those of motorcycling and motor cycle history, the histories of the cycle and motor industries, and to a lesser extent transport history in general and the histories of several other industries; those of standardization, design, and production methods; those of product development, consumer behaviour and marketing; and also to some extent, those of the theory of the firm, entrepreneurship, business and industry history in general, and English economic history.

CHAPTER 2

THE TREND TO STANDARDIZATION

The aim of this chapter is to prepare the way conceptually for the empirical analysis which follows later. Thus it is concerned primarily with developing the idea of the trend to standardization into a concept, and then formulating, analysing and discussing that concept.

Standardization is viewed initially as part of a developmental process which characterizes all life, and from the analysis of this process there emerge the various kinds of standardization: functional efficiency standardization (FES), production efficiency standardization (PES), and marketing efficiency standardization (MES).

The treatment of each of these categories varies more for substantive than analytical reasons. FES is discussed largely in design and engineering terms. PES is examined both from a technical and historical point of view, but with the emphasis on the latter. MES, which follows in Chapter 3, is analysed in some detail in terms of various ideas current in marketing and product development practice and research, and it is from this chapter more than any other that we begin to arrive at an explanation of the tendency for products of industries such as the motor cycle industry to become increasingly standardized.

As Chapter 3 is a continuation of Chapter 2, the conclusions to the two chapters will be found at the end of Chapter 3.

Introduction

Standardization is usually thought of as the process of devising and establishing standards the main purposes of which are to improve industrial efficiency and to provide guidelines to producers and consumers as to what should be expected from a given type of product. Standards created

in this way may be simply formal and have no reality in fact, that is, there may be little or no relationship between the standard as it is formulated and the standard as it exists, if it exists, in the field. From this starting point, a great deal has been written on standardization and the establishment of standards in particular industries, treating standardization as entirely a formal process involving the setting up of standardization committees at a national or industry level, and related activities performed as a management function in individual companies.¹ The result is to emphasize the political aspect of standardization even sometimes at the expense of economic considerations and always at the expense of the more immediately personal or human element.

The fact is, however, that standardization is a natural process which takes place much of the time unconsciously, that is, without the intervention of deliberate decision-making. It operates in this way through something akin to natural selection. The driving force behind natural selection is efficiency, not in its narrow economic sense, but in the biological sense as "survival value". Standardization has survival value in that it contributes to those essential activities which enable the organism to survive and prosper in its particular environment: activities which involve various kinds of efficiency.

The survivors in the biological context are those species which have adapted more efficiently to their environment. The survivors in an industrial context are likely to be the firms which are most capable of manufacturing products which people want to buy, usually those products which perform most effectively and are manufactured most efficiently so as to ensure the most attractive combination of price and quality. In any market such products will sooner or later emerge and become recognizable standards, but this is not the end of the matter.

It may seem that standardization as an activity is brought to an end as soon as the requisite standard has been established not merely as a formula but as a living

entity, at which point the standard itself becomes a permanent feature of the landscape. In practice, however, standards are rarely permanent. A particular standard is rarely considered to be the ultimate development of its kind. There is nearly always room for improvement and often need for it as times change. Thus if there is any constancy it is not in the standard but in the process of standardization which is why it is so aptly described as a trend. The trend signifies a continuing movement towards a given kind of end which may or may not be achieved, a point which is not always recognised in the more conventional definitions of standards and standardization which follow.

Standards and Standardization

There is little to be gained from discussing definitions of standards and standardization separately except to note that standardization is the process while standards are the end product. We may assume therefore that what applies to one will apply to a large extent to the other also.

Standardization has been defined in various ways. Early definitions, particularly, emphasized the more static formal element. Thus it was seen as "the definition of specifications for products, parts, and materials recommended or adopted by an entire industry",² or, in similar vein but with a slightly different perspective, as "the preparation and application of definite specifications which are either compulsorily enforced or voluntarily adopted in connection with production or manufacture or with the sale or marketing of raw materials, natural products and food-stuffs".³ Thus, rather than being recognised as an evolutionary process, it might be recommended or enforced: a matter for advice, or more than that, for governmental activity in which an element of compulsion could be involved.

Various levels of standardization have been recognised:

1. interchangeability of parts of different models;
2. production of similar parts in the same factory;
3. decreasing the number of types of product;
4. standardization of the products of groups of manufacturers as a result of common components;
5. determination of standards for the whole industry, such as for screw threads;
6. standardization by the military authorities for control layouts, etc.⁴

In a wider perspective it has been seen as an all-embracing concept covering not just manufactures, but behaviour as well: "A standard is a formulation established verbally, in writing or by any other graphical method, or by means of a model, sample or other physical means of representation, to serve during a certain period of time for defining, designating or specifying certain features of a unit or basis of measurement, a physical object, an action, a process, a method, a capacity, a function, a performance, a measure, an arrangement, a condition, a duty, a right, a responsibility, a behavior, an attitude, a concept or a conception".⁵

Later definitions shifted from the overemphasis on the purely formal aspect of standardization to the subject of efficiency and they also began to recognise the time factor: "Standards are practicable, profit-proving solutions to recurring problems. Established tentatively, they are couched in objective terms and are based on the consent of those affected. They facilitate and often promote general usage of the best thoughts and practices on the subject being standardized. Standardization is an evolutionary process whereby standards are established".⁶

Possibly the ultimate development of the concept has been its presentation as a distinct discipline from which very little is excluded: "applied science, technology,

industry and economics play extremely important parts. Human psychology, public relations, management and other social sciences are also involved. In very general terms its object may be described as the regulation of man's relationship to man in respect of the daily exchange of goods and services. Each one of these wide fields of knowledge contributes to standardization".⁷ There is little to quarrel with in this statement if we interpret it to mean that standardization is one of the main organizing concepts of human existence. But as a definition it is too general and too wide-ranging, and whether standardization should be treated as a separate discipline is debatable.

We can arrive at a more satisfactory conclusion through a definition formulated by the International Organization for Standardization: "Standardization is the process of formulating and applying rules for an orderly approach to a specific activity for the benefit and with the cooperation of all concerned, and in particular for the promotion of optimum overall economy taking due account of functional conditions and safety requirements. It is based on the consolidated results of science, technique and experience. It determines not only the basis for the present but also for future development, and it should keep pace with progress".⁸

This definition acknowledges both the formalizing and efficiency aspects of the standardization process, the role of present standards and the need for future change, and so far as it goes it is the most realistic of the definitions discussed here. However, it fails like all the others, in that it gives no account of standardization as an unplanned activity somewhat in the nature of a natural trend. It is to this we now turn.

Standardization as a Natural Trend

Standardization is much more than a formal activity carried out in the interests of achieving greater efficiency in human affairs. It is a natural process⁹ rather than initially a man-made one in that it occurs widely

throughout the natural world without the operation of conscious direction or will (unless one believes in the efficacy of divine intervention). The universe, insofar as we know it, has been built up of standard units, atoms (and probably subatomic particles), which are identical within each particular class. Atoms of iron are identified by their standard qualities—their similarities, and distinguished from other atoms by their differences.

Similarly, species are identified as distinct groups, the members of which have many characteristics in common, while being different in varying degrees from the members of other species. Species are subject to processes of natural selection and a concept of fitness.

The theory of natural selection is so crucial to the present argument, that it is worth a closer examination. Darwin's theory is based on three observable facts and two deductions which can be made from them. These are:

1. The tendency of all organisms to increase in a geometrical ratio;
2. Despite this tendency, the numbers in a species tend to remain constant, indicating that "there must be competition for survival";
3. All organisms vary appreciably.

Thus, since there is a struggle and all organisms are not alike, some variations will be advantageous in the struggle for existence and others less so. Consequently, a higher proportion of those with favourable variations will survive and a higher proportion of those with unfavourable variations will die or fail to reproduce.¹⁰

In sum, survival of organisms is not simply a matter of chance, but is dependent on factors or characteristics which operate systematically to distinguish those more capable of surviving from the remainder.

A species tends to become defined by those factors which contribute to its survival potential and mark it out from others. As the nature of the environment varies, so the characteristics which favour survival will vary also.

Species survive or decay to the extent that they are well adapted to their environment and thus they will become specialised and localised, and, for the survivors, increasingly efficient.

Efficiency is the prime driving force behind standardization, even more so when it is the result of an autonomous natural trend than when it is a formal and deliberate activity. A species tends to take on that form which most favours survival in its particular environment, and this applies no less to human activities where we find that, even in the distant past, standards have developed as a result of the natural and unplanned outcomes of human existence. Thus it has been observed that "Whenever we find people living together in groups, whatever be the group basis upon which they live, we find habitual, set, and highly routinised behavior".¹¹ Such habits and behaviours, customs and rules, were "the first standards of life".¹²

The same kind of trend also applies to man-made objects which tend to be developed more or less unconsciously into those forms which are most suitable to serve the given purpose. Stone-age axes occur in much the same shape and form wherever they are found.¹³ The most likely explanation for this is the need for functional efficiency. A tool which has to fit the hand, which requires a cutting edge and a certain amount of weight to increase the power of the cutting stroke, would tend to evolve into a common form because that form is more convenient and efficient in use than alternatives.

Standardization of tools and technologies, then, evolves around the superior method or "one best way" of performing a given task,¹⁴ subject to various factors which may modify performance such as, for example, prevailing social and economic conditions, the level of technological advancement, the availability of materials, etc. Standardization which develops in this way will be termed **functional efficiency standardization (FES)**.

But standardization is not confined to the adoption of

designs and technologies which are intrinsically the most efficient available for a given purpose. Often the major issue is practical or productive convenience and the particular standard adopted is arbitrary rather than functional in that what is most important is that a standard exists, rather than that the standard should be one thing rather than another. There is often no apparent functional efficiency standard but it is advantageous to have some kind of fixed standard rather than none. Weights and measures belong to this category, the category of **arbitrary standardization**.

Weights and measures arose haphazardly through practical necessity and custom. Linear measurements developed literally by "rules of thumb". The breadth of a thumb was an inch; the length of the foot, 12 inches; the yard was the distance from the centre of the body to the fingertips with the arms outstretched.¹⁵ Such measurements would have been satisfactory for individual workers, but rather less so for trade or for people working together in groups. Thus more objective standards would become necessary and would be set up arbitrarily, perhaps at first by group leaders, later by local officials or governments. And however systematic such standards may be, there is as yet no logic by which weights and measures may be devised without some arbitrary element.¹⁶ The basic unit of any system of measurement is arbitrary, and therefore all standards based primarily on measurement are in some degree arbitrary also.

However arbitrarily it may be devised, a system of weights and measures though not easily related to functional efficiency, has a clear and obvious relationship to production efficiency. Standard measurements are essential for efficient production, and really are a subsection of what will be termed **production efficiency standardization (PES)**.

PES occurs when a manufacturer standardizes his production by the universal adoption of a particular component or set of components in order to simplify his manufacturing

operations and reduce costs. This is the one situation where standardization is more likely to follow as a result of deliberate policy than from the operation of an unconscious trend.

However a particular production efficiency standard is arrived at, it can easily clash with the demands of functional efficiency. Too much emphasis on production efficiency may result in the production of goods which sacrifice quality or performance. Too much emphasis on functional efficiency may result in goods which are rather more expensive than others in the same product class. Depending on the nature of the market, the majority of manufacturers are likely to concentrate on one type of product rather than another, emphasizing either quality or price, or they may seek some kind of compromise between the two.

In present-day conditions it is more often the mass market which offers the greatest potential reward to the manufacturer, than the more limited market for higher-priced, quality goods. The nearest approach to a standard product in a mass market is the kind of product (in terms of basic format, price range, etc.) which sells in the largest numbers, the product with the widest possible appeal. Market research aims to investigate the nature of this appeal by trying to identify the product characteristics which are most important to the majority of consumers. The successful product will tend to incorporate such characteristics, and when a particularly successful product appears on the market, other manufacturers will attempt to emulate it. Thus in a mass market there usually exists a trend to standardization in terms of the kind of product which appeals to the largest number of consumers. Any movement in this direction, and particularly the copying of successful products by other manufacturers, will be termed **marketing efficiency standardization (MES)**.

MES is largely a result of the pressure of consumer demand. Thus it may be differentiated from the more general concept, "product standardization", which has been defined as "a process by which increasingly specific

product aspects become similar across firms".¹⁷ Product standardization will generally be taken to indicate standardization which results from the effects of all the different kinds of standardization discussed here: arbitrary, functional, production, and marketing.

Standardization is a continuous process rather than a finite one. The standards that arise from these various kinds of standardization are more likely to be transient than permanent as new technologies are developed, new materials become available, and consumer preference is influenced by changes of taste and fashion as well as advertising. We can get a better understanding of this issue by examining in more detail and to some extent historically the different kinds of standardization.

Functional Efficiency Standardization

Functional efficiency standardization (FES) refers to the trend for makers and users to adopt the most efficient design of a given product. The most efficient design is that which serves a given purpose or function most effectively. Thus there is no simple answer to the question—What is the best designed product?—since the answer depends on the product's intended use. A dining table, for example, may differ considerably from a table required to serve as a firm work surface capable of taking heavy loads without upsetting. While both tables are likely to have four legs and a solid top, the dining table could well be round rather than rectangular. Given that room space is adequate, a round table can be far more convenient for seating several people than a rectangular one, since it makes it easier to allow each person the same amount of space and avoids cramping or waste of space at corners.

A round table, however, would not serve very well as a work surface intended to support heavy loads, since between each pair of legs there would be a section which overlaps the axis of support provided by the legs. A heavy weight placed on any such section would be likely to upset the table. A rectangular table, therefore, with legs at each

corner and little or no overlap, would be a far better design as a work table than a round one.

Even though there may be a best design for any given function, it is not always possible to design a product in accordance with it. Many products are expected to serve several different and sometimes divergent functions, and so some compromise is necessary in their design, some trade-off between designs for one function and another. A round table might be supplied with fixings to attach it to the floor so that it becomes more stable at the cost of reduced mobility. A square table might be fitted with flaps to convert it to a round one when required.

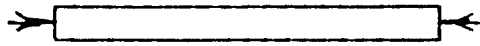
Thus there are always likely to be gains and losses in the design of a product. Effective design depends on the principle of "totality", that is, taking all relevant factors into account,¹⁸ and often some degree of functional efficiency will be sacrificed in order to simplify production and reduce costs, or to give the consumer what he wants in some other respect.

As we have already seen in connection with stone axes, the trend to FES has existed since the earliest man-made artefacts. It seems likely also that it has continued throughout the history of technology. But rather than attempting a general review here which would go beyond the scope of the present research, the following discussion will concentrate on the development of the bicycle frame which is not without relevance to the development of the motor cycle which is discussed in later chapters. The aim will be to demonstrate how technical issues in design may be compromised by other considerations.¹⁹

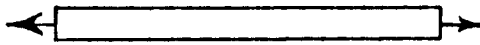
The development of the bicycle frame has been based on two distinct kinds of activity: 1. solving the practical problems of designing and manufacturing a bicycle which will sell at a profit, and 2. the application of basic mechanics.

The parts of the bicycle frame are likely to be subjected to various different kinds of stress, of which it is sufficient for present purposes to consider only

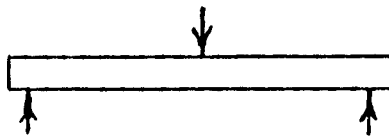
compression and tension stress (figs. 2.1a and 2.1b) which act parallel to the axis of a beam, and bending stress which acts transversely (fig. 2.1c).



a. compression stress



b. tension stress



c. bending stress

Fig. 2.1. Some stresses acting on a horizontal beam
The arrows indicate the directions of the forces applied

The frames of the earliest bicycles were constructed from solid metal bars. This form of construction made the machines very heavy while the extra weight added little or nothing in strength as compared with tubular construction, which soon became the standard form.²⁰

The transition from solid to tubular frames took place relatively early in the development of the bicycle, but the form of the standard frame itself was rather longer in developing. The frame of the high-wheeled "ordinary" (or penny-farthing) consisted of a single beam, known as the spine, which curved around the large front wheel on its way to meet the small trailing wheel (fig. 2.2). With the seat

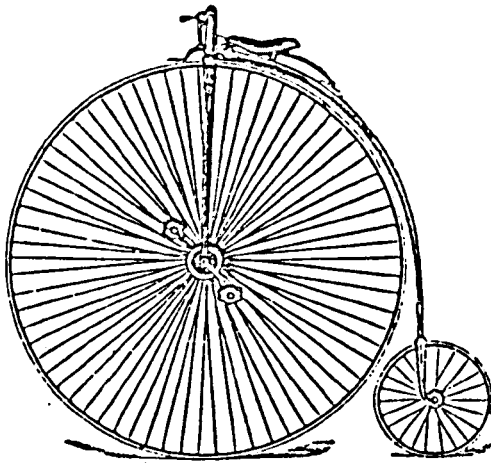


Fig. 2.2. The "Ordinary" Bicycle
("The Cyclist", 22 June 1881)

placed near the top of the spine, the latter would be subject to a bending stress acting downwards and across its axis. The spine therefore had to be particularly strong.

A more scientifically designed bicycle frame, constructed so as to eliminate bending stress, could be lighter without loss of strength, but this could not be achieved until the safety bicycle was developed. The first safety bicycle designs appeared from about 1876 onwards, but a mechanically satisfactory and commercially effective design was not constructed until the mid-1880s. By 1890 the safety bicycle had been developed into its modern form with diamond frame (fig. 2.3).

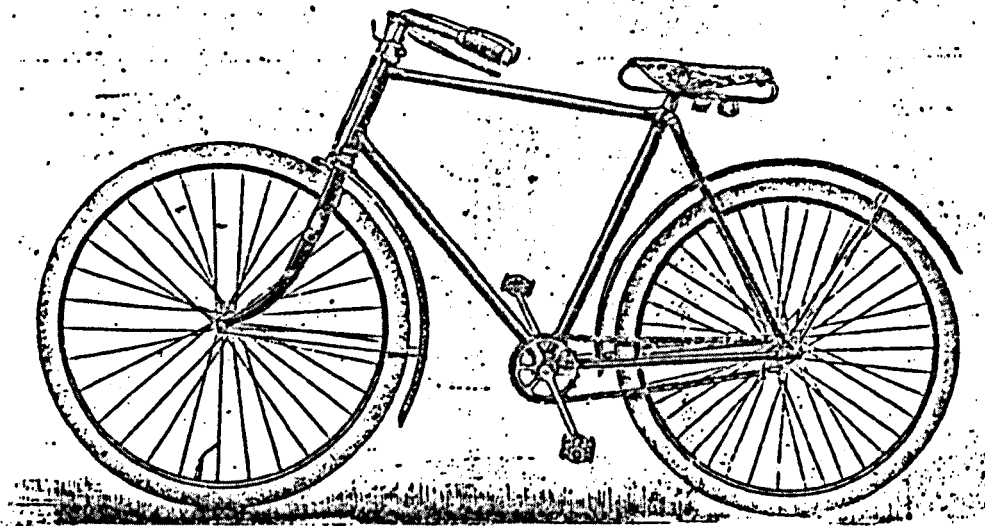


Fig. 2.3. A Diamond-Frame Bicycle
("The Cyclist", 28 November 1894)

However, the frame illustrated which dates from 1894, does not eliminate bending stress. In order to do so it would have to satisfy the condition that "the axes of the top and bottom tubes should if produced, intersect at a point vertically over the front wheel",²¹ the point P. As may be seen by the dotted lines AB and BC in fig. 2.4, (an outline of fig. 2.3), the necessary condition is not met in this design. The reason for this is that in designing a cycle frame, other factors also have to be taken into account, like, for example, wheelbase, which makes it difficult to meet such exact design prescriptions.²²

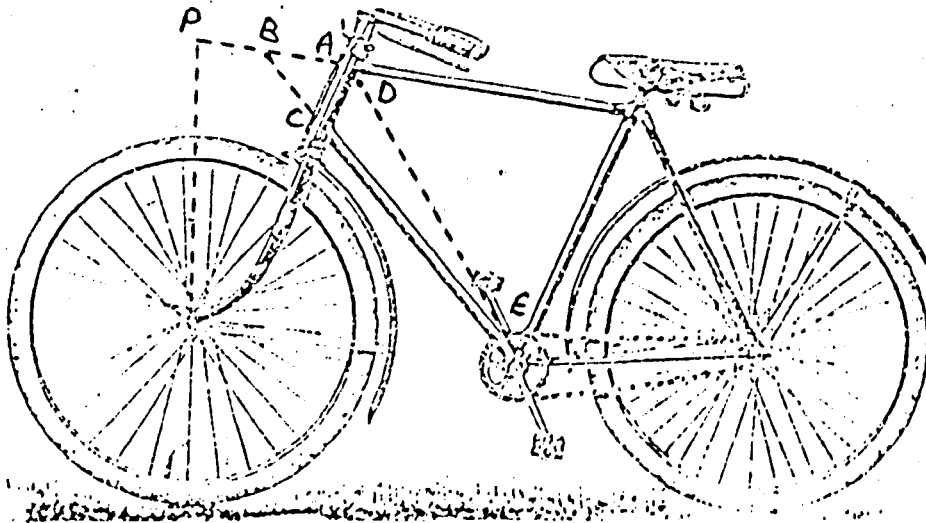


Fig. 2.4. Diamond Frame Design

There are two ways of dealing with this problem. One is to stay with the standard diamond frame but to strengthen those members which are subject to bending stress, thus making the frame heavier than it would otherwise need to be. The other is to insert an extra tube, as represented by the dotted line DE (fig. 2.4), which would convert any bending stress into a compression stress on the new tube. The result would be a better designed frame which would be, however, more expensive to make.

The majority of cycle manufacturers preferred the former course, that is, to stay with the simpler, standard

frame, strengthened to resist bending stress, cheaper to produce, but heavier and therefore slightly less efficient in operation than the best designs. This represented a trade-off between functional efficiency and production efficiency, and also, in view of the lower price, marketing efficiency. The outcome was a design which has survived to the present day and still retains considerable popularity.

Functional efficiency therefore may be the initial consideration when it comes to design, but it can rarely be the final one. The most efficient designs from a technical point of view may be difficult and expensive to produce. Ease of production, cost-effectiveness, and marketability, may all be more important at times than the ultimate in performance. Much will depend on the nature of the product and the kind of market it serves. With luxury products aimed at a very limited market like, for example, the Rolls-Royce car, a ten per cent increase in price would probably have little effect on demand, so that manufacturers can afford to place maximal emphasis on technical efficiency. In contrast, ten per cent on the price of a small car intended for the mass market might lead to substantially reduced sales, so that a much greater degree of technical efficiency is likely to be sacrificed to production and price considerations than with the luxury car. Thus for many products and particularly for those in the lower price ranges, production efficiency will often prove to be more important than functional efficiency.

Production Efficiency Standardization

Production efficiency standardization (PES) refers to the tendency for products to be standardized in order to facilitate manufacture by more efficient and more cost-effective technology. Although we might think of PES as largely a modern development, there is no reason why it should not have existed in simple form far back in time. Any craftsman working alone is likely to develop his own standard methods of working when producing the same kind of article again and again over many years. The use of parts

of the body for purposes of measurement was an early step in this direction.

Perhaps the first positive move towards a production efficiency standard with effect beyond the activities of the individual worker, was the adoption of a measurement system. Standard forms of measurement have been traced back as far as 3000 BC.²³ But for the development of a system of measurement to serve the particular requirements of a firm or industry, we have to come much more up to date and almost to modern times, to the sizes of type bodies in the French printing industry in the eighteenth century.²⁴

The sizes of ancient type bodies²⁵ were arbitrary and varied considerably. In 1737 Pierre Simon Fournier first formulated his point system. The need for the new system arose when, in attempting to establish his own foundry for the manufacture of type, Fournier "found no rule to guide me in fixing the body of the characters which I am obliged to make".²⁶

The point system was published in its final, perfected form in 1764. The basic unit was the point of which there were 72 to the inch, which was later standardized on the "pied du roi" containing 12 French or 12.7892 American inches.²⁷ Thus the size of the point was quite arbitrary, but the development of a system of standard sizes was of great benefit. Much the same thing could be said about most forms of production technology. It is not so much what the standard is that matters, but the fact that a standard exists at all.

Meanwhile, accurate official standards of measurement were being established for more general purposes. These were usually based on standard weights or lengths of metal kept at an official repository, and from which reference gauges could be constructed for local use. Once the standardization and accuracy of measurement was assured, it became possible in theory if not yet in practice to manufacture components of standard size which would be readily interchangeable with others. With hand-crafted products this was unnecessary since nonstandard components could be

adapted to each other at the final fitting and assembly stage, and, indeed, it was not expected that parts would fit easily together without a considerable amount of work. In Birmingham gun-making in the 1850s it required more workers to finish and fit together the separate components than was required for their original manufacture.²⁸

Among the first to develop manufacture by the system of interchangeable parts, was the firm of Bolton and Watt which had an interest in Cornish mining. The firm supplied pumping engines for the mines and in 1780 it realised that there was a need for a stock of certain engine parts for the pumps, otherwise a mine might be ruined before the new part could be made.²⁹ Later on, in response to a rush of orders for its products, the firm began to build engines to standard patterns in order to concentrate production on a limited number of engine sizes.³⁰

But much more impressive than the efforts of Bolton and Watt or anything else of the sort so far achieved elsewhere, was the Portsmouth blockmaking machinery—probably the first powered machinery capable of mass producing interchangeable parts to precise specifications.³¹ In the days of sail, pulley-blocks were in great demand. A 72-gun ship required 922 blocks, and it was estimated that consumption by the Royal Navy early in the nineteenth century was 100,000 a year.³² The machinery was developed as a result of the suggestion of Brigadier General Sir Samuel Bentham that the government should manufacture blocks for naval stores by power-driven machinery. It was Brunel, however, who actually designed the machines and installed them, and they proved so effective that, according to claims made at the time, they enabled 10 unskilled men to do the work of 110 skilled blockmakers.³³

These early efforts would seem to have given Britain a significant lead in the development of standardization and mass production technology. Much of British industry, however, was rather slow to follow the example of the pioneers with the result that, perhaps unfairly,³⁴ most of the credit for originating mass production is usually given to

the Americans, Eli Whitney and Simon North. About the time the blockmaking machinery was being developed in England, Whitney and North were given contracts by the American government to manufacture firearms by the interchangeable parts method.³⁵ The advances they made were of great significance, but were, nevertheless, a good deal short of full interchangeability and progress was much slower than is sometimes thought.

In the 1790s the degree of uniformity in muskets produced at the Springfield Armory was limited to what was required by pattern, which meant that the finished product did not have to conform exactly to the given dimensions. Muskets might vary as much as 1.5 inches in length (3%), and although they had to accept standard bullets, even these could vary to some extent "as empty paper cartridge was wadded over the ball".³⁶ Under this system, one gunsmith would make the whole gun himself. Great skill was needed to fit the parts together and if one part broke the gun would be totally useless and could only be repaired by a skilled armourer.

When Whitney came on the scene, his aim of full interchangeability was far from reality and would remain so until the development of better machinery. With only rather crude machinery at his disposal, he depended on filers to finish off parts.³⁷ Thus the level of interchangeability he achieved "meant little more than a degree of similarity sufficient to allow relatively unskilled armorers to fit parts from broken weapons with a small amount of fitting or adjustment".³⁸

In 1812 the US Ordnance Department began to call for stricter adherence to the contractual terms regarding interchangeability, and in 1815 Congress called for greater standardization in ordnance supplies.³⁹ A new musket was designed by Lt. Col. Roswell Lee of the Springfield Armory, but it was much as before, based on handicraft design, since full interchangeability was still not possible with the machinery then available.

It was Lee, however, who promoted the most important

advance. During his time at Springfield he encouraged inventors by offering them "space, power and economic incentives".⁴⁰ One man he invited to Springfield was Thomas Blanchard who was already involved in producing lathes for arms manufacturers. In two years Blanchard had developed a lathe for duplicating irregular forms which could produce a gun stock in nine minutes. From this beginning various other lathes were developed which could turn out accurate components in both wood and metal, making it possible to manufacture parts with unskilled labour which had previously required a high degree of skill in their production.⁴¹ Until then it had been impossible to produce a truly standard musket.

Full interchangeability was first achieved at the Springfield Armory in the 1840s and it set an example for industrial production which spread rapidly to other parts of American industry and overseas, so much so that the system of mass production by standard interchangeable parts became known as the American system of manufacture.

Meanwhile, there were comparable advances in some parts of British industry while others lagged. In the 1830s James Nasmyth began to manufacture machine tools in standardized form.⁴² In 1841 Joseph Whitworth proposed the first standard for screw sizes in a paper read before the Institution of Civil Engineers.⁴³ In the same decade the Great Western Railway began to build its locomotives to standard patterns, but the British market was not big enough to enable any British manufacturer to build standard locomotives for stock on a large scale.⁴⁴

Despite this progress most customers in the machine tools industry continued to insist on machines designed to their own ideas,⁴⁵ and even in newer industries and much later in the century, Britain continued to lag in the adoption of new methods. Thus in the cycle industry, an industry in which Britain led the world, it was only the combination of competition from cheap American mass produced bicycles plus overproduction in the home industry during the mid-1890s, that led the British to reduce prices

by standardizing their production and adopting more modern methods.⁴⁶

But while British technology lagged, the Americans continued to move ahead. The most revolutionary step forward in mass production technology came soon after the turn of the century with the development of the assembly line, and, perhaps more important still, the kind of product that made it worthwhile. This took the form of Henry Ford's Model T.

There was little or nothing innovative about the Model T as a motor car. It was a standard model, intended to appeal to the typical conservative, average consumer. Every feature has been fully tried and tested in practice. It was designed so as to minimise cost and simplify production to the greatest possible degree. But Ford carried the standardization process to absurd lengths, as illustrated by his famous remark: "Any customer can have a car painted any colour that he wants so long as it is black".⁴⁷ In production efficiency terms this decree was probably justified; in marketing terms, less so. But this idiosyncrasy did not detract from the success of the Model T.

It was a success which owed much to the new technology and yet it owed even more to the market and the product that was created to serve it. Henry Ford's genius was in being the first to appreciate fully the nature of the potential market for cars, and in creating the kind of product that would make it a reality: "Actually he invented the assembly line because he had concluded that at \$500 he could sell millions of cars".⁴⁸

Thus it is the market more than any other factor which gives substance to the trend to standardization in manufacture. But as will be seen in later chapters and, if we are to take the example of the motor cycle industry as illustrative, before the market can be developed to any great degree, the product itself must be approaching some degree of standardization. Henry Ford could not have created a mass market for cars if consumers did not already have an idea of what a car should look like and what it should do.

Only then could they have seen their ideas realised in such as the Model T.

Yet whatever the influence of the market, PES is the most obvious form of standardization, the most obviously beneficial form, and is probably the most easily applied. If manufacturers can standardize their components and the technologies they use in manufacture they can often simplify production and reduce costs over a wide range of activities. In the past, however, these advantages were usually far from obvious, and it was only as a result of specific problems and attempts to solve them that standardization developed.

The efforts of Fournier in France, and Boulton and Watt in England, were not prompted initially by any particular wish to standardize their products but represented a response to particular problems, and are best to be understood as evolutionary developments. The revolution sometimes implied by accounts of the development of the so called American system of manufacture, was not wrought practically overnight by Whitney and North but was the result of decades of development work most of which was completed after they had left the scene, and much of it elsewhere.

The early advances which took place in Britain were less than enthusiastically received by much of British industry. The reason for this is not hard to find. The first mass produced, standardized products often seemed cheap and poor quality compared to the hand-crafted product. Possibly they were. Also, British consumers were accustomed to products made to their own particular requirements and many did not wish to risk ordering something which might prove to be of doubtful quality.

Ultimately, it is always the consumer who decides whether a new product will succeed or fail in the marketplace. It is the consumer who will choose between the high priced product of maximal functional efficiency and the cheaper mass-produced article. Thus although manufacturers might set out to develop technically superior products or

alternatively to implement a programme of component or product standardization, there is no certainty that consumers will buy the new products. Acceptance of standardized products in place of traditional hand-crafted, custom built articles, requires a fundamental change of attitude which is likely to be as much an evolutionary process as the development of standardization technology itself. As will be seen in the next chapter, few consumers are quick to adopt a product that is in any sense radically new.

CHAPTER 3

MARKETING EFFICIENCY STANDARDIZATION

The last chapter defined standardization and discussed how it takes place much of the time unconsciously as a trend rather than as a policy requiring the intervention of deliberate decision-making. It went on to analyse the trend into three main components, functional efficiency standardization, production efficiency standardization, and marketing efficiency standardization, and then proceeded to discuss the first two of these at length, arriving in each case at the conclusion that the market is likely to be a major determining factor.

In this chapter the discussion is extended to the influence of the market on the trend to standardization. The market, for present purposes, involves just two main factors, the product (including by extension, the producer) and the consumer.

The product is examined in terms of two issues, the meaning of "new product" and how far it pays to innovate. The term "new product" is analysed into five categories in an attempt to overcome the ambiguity of so called new products which are not really new, but represent nothing more than minor modifications to existing ones. As the discussion develops, it emerges that the most successful new products are likely to be only moderately innovative and not substantially different from established ones.

The typical consumer is found to be inclined to caution where the purchase of new products is concerned and this is in line with what has already been learnt about product development in general, and gives further support to the idea of the trend to standardization.

Introduction

Marketing efficiency standardization refers to the trend for the products of a particular industry to become more and more alike through the pressure of consumer demand. It is a result of the tendency of most consumers to prefer the safe, reliable product of known reputation and performance, to that which is new, unfamiliar and untried, combined with the inclination of most producers to cater for existing demand rather than to embark on the uncertainties of innovation.

This does not mean that producers will never innovate, nor that consumers will invariably reject the innovative product. What it usually means is that the majority of both consumers and producers will tend to hold back from adopting the radically new product until somebody else has proved, for the producer, that it can be manufactured and sold at a profit, and for the consumer, that it works and offers a discernible advantage over other products—until in fact it is no longer particularly new.

This conclusion raises various problems: What is a radically new product? If most consumers are likely to reject such a product, how is it possible for producers to innovate at all? Are less radically innovative products which, nevertheless, seem to be new, new, only as a result of illusions created by some kind of conjuring trick of the marketers, or do they offer something new though of a lesser order? But the first thing that must be considered even before examining the meaning of "radically new" is to define "new product".

The New Product

The product can be defined from the point of view of the producer, the marketer, the potential consumer, or the buyer. Thus there are various definitions of which the following are intended to be merely illustrative of the main approaches:

- (1) "thing or substance produced by natural process or manufacture";¹

(2) "anything which requires marketing to anybody";²

(3) "a cluster of anticipated customer benefits";³

(4) "a material item, or service that is purchased in the course of fulfilling a business goal".⁴

The last of these refers to an industrial rather than a consumer product, but for the purposes of the present discussion this makes little difference. The main point to be made is that the product is usually defined according to the perspective of the definer, and therefore it is hard to define product in a meaningful way except with reference to a particular context. It is scarcely an exaggeration to say that the context defines the product. This is particularly the case with the new product.

The term "new product" is usually defined as "a product that is new to the company".⁵ But, as we shall see, this means it can be applied to almost anything. As one writer observes, it "seems to be applied to any product that requires a change in marketing direction".⁶ Furthermore, new products can represent replacements, extensions or additions to a previous range⁷, or they may be old products presented in new packaging or delivered to new markets.⁸ They can introduce changes in cost, convenience in use, performance, method of use, and appearance.⁹ Thus there may be very little that is new about the new product, although it has been suggested that they "must be sufficiently different from the existing alternatives to constitute a basis for genuine consumer preference".¹⁰

What is defined as new may vary in novelty from the highly original product which has not been seen before, to the old, long established product, presented and marketed in a new way. Such a concept of new product has little or no analytical value and does nothing to indicate just how new is a radically new product. Is it something which has never been seen before in any form or can it be an old product which has been given a new function or greatly improved performance? There is of course no ultimate answer to this question because words only have the meanings which we give them. The problem then becomes one

of analysis rather than words, and as a step in this direction it is worth attempting to identify and define the different kinds of new product. Five are suggested below but no claim is made to suggest that this list is exhaustive.

1. **The imitation** - the product that is new in that it is new to the company, but is otherwise identical to some previously existing product, except, that is, in terms of brand name. Patent-expired drugs are a good example.

2. **The new package** - the product that is basically as before in terms of function and use, but has been subjected to changes in packaging, colour scheme, styling, price, marketing, etc. Many own-brand supermarket goods come into this category.

3. **The improvement** - the product which is the same in principle as before but which has been subjected to improvements which amount to small changes in efficiency and use. A good example is the development of five-speed gear boxes to replace the old four-speed ones.

4. **The major improvement** - the product which is still the same in principle as before but which has been subjected to improvements which result in major changes in efficiency and use. In technical performance alone (not in commercial terms) the Concorde is an example of this since it substantially reduces flying time. But as an aircraft it is much the same in principle as subsonic aircraft despite the new technology associated with supersonic flight.

5. **The new concept** - the product, the like of which has never been seen before. When first introduced, motor vehicles, telephones, radio and television, computers, etc., were all in this category. There is no way it can be argued that the motor vehicle was simply an improved form of horse-drawn carriage, since it was "horseless", an entirely new concept.

Of these five categories, 1 and 2 are new primarily in marketing terms only, since what is new has been added on by the marketer rather than the designer. They could never

be described as radically new though some of them might be genuinely new in a very limited way in that they may offer the consumer additional choice as, for example, in the case of new colour schemes.

Category 3, the improvement, is genuinely new in that it will usually offer some technical improvement resulting in improved performance, but this will be achieved without changing the basic design and format of the product.

The major improvement, category 4, would certainly be new in a way that was beyond dispute, but not necessarily radical. Returning to the example of the Concorde, this might be seen as radically new from the manufacturer's point of view as it is based on new technology. It might be considered no less radical from a marketing point of view, in that it offers a unique service to those few who can afford it and for whom every minute counts. But the uniqueness of the service offered rests in its sheer speed and does not amount to anything in the nature of an entirely new concept; the increased speed is an improvement on other services rather than something radically new.

The new concept, category 5, is always radically new by definition.

It is possible now to reduce these five categories to three main concepts: (a) the product that owes its novelty mainly to the marketing process; (b) the product that offers improved performance in operation as a result of some kind of technical advance; and (c) the product that will perform the kind of function that has never been available before. In general, products in category (a) will be looked upon as noninnovative, and those in categories (b) and (c) as innovative.

In the later chapters of the thesis, the most important distinction, and a critical one, is that between (a) and (b), the non-innovative and the improved product. The motor cycle could only be invented once, and so the new concept product does not play much part in the discussion.

Whichever category a new product belongs to, there is never any certainty that it will succeed commercially.

Many new products are put on the market, but evidence suggests that most of them fail, perhaps as many as 90% for some categories.¹¹ There is no indication as yet of what proportions of the successes and failures of such new products are genuinely new, but there is evidence to suggest that innovative products may sometimes do less well than products based on old technology.¹² Thus we come to the question, does it pay to innovate, or is it better to concentrate on the development and sale of products which are little changed except for the rather cosmetic improvements generated by the marketing process?

Does It Pay To Innovate?

The constant emphasis on the need to innovate, not only in the speeches of politicians but in the literatures of social science in general, and economics, management and marketing in particular, leaves little doubt of the existence of a popular assumption that it does pay to innovate. This assumption would seem to be borne out by the fact that many new products are put on the market and survive to achieve substantial profits. According to one source, "It is commonplace for major companies to have 50% or more of current sales in products new in the past ten years".¹³ And this, we may observe, occurs despite the high failure rate of new products previously noted. The problem is that such statements tell us very little about just how innovative are the new products in question. It is possible that many of these products are not innovative in the sense previously defined, and this would not be surprising, since there is considerable evidence that it often pays to develop non-innovative new products.

Many new products are imitations. Imitation of a successful new product is likely to pay not simply in terms of sales but in avoiding the risks of developing new products for which there is as yet no sure indication either that they will work or that they will sell.¹⁴ Just how important imitations are will depend on the size of the market, the nature of the product itself, and the industry.

Once a genuinely new product has been developed and proved a commercial success, imitative products will appear and may in time take a major share of the market.¹⁵

Like imitations, old products which are re-presented to the consumer in new forms of packaging are also essentially noninnovative. Newly packaged products come in many different forms. Many otherwise familiar products can be found on supermarket shelves as "own brands" and often at bargain prices.¹⁶ Here the method of presentation, or the price, may be more important than the brand name, and there is little doubt that it often pays to re-package products into such form particularly for chain-stores with large-scale purchasing and marketing facilities.

But new packaging can go much further than this. An old product can be entirely restyled and yet still retain its original character at least in terms of function and performance. Restyling rather than genuine innovation has been particularly prevalent in the motor industry where efforts tend to be "mainly concerned with constant minor development of traditional designs and with fashion changes".¹⁷ Nevertheless, companies have increased their market share substantially, and with little or no change in basic technology.¹⁸

Such efforts often belong under the heading "product differentiation" which is a characteristic response when products have become too much alike or when it is desired to increase their competitiveness without innovating more radically: "A general class of product is differentiated if any significant basis exists for distinguishing the good (or services) of one seller from those of another".¹⁹ Differentiation may be based on "exclusive patented features; trade-marks; trade-names; peculiarities of the package or container, if any; or singularity in quality, design, colour, or style".²⁰

What this often amounts to is to make products look different while they remain very much the same. A good example is the Ford Model A which was introduced in 1927 to replace the Model T. Other manufacturers had turned to

styling in order to compete with Ford with the result that Ford's market share had fallen. In response, the Model T was restyled and became the Model A which "was significant not because the design was innovative but because it was not".²¹

The fact that it often pays to develop new products which are essentially noninnovative, does not necessarily mean that it does not pay to innovate more radically. The problem here for the producer is the risk and uncertainty involved.²² Radically new products often need a great deal of development work before they are entirely effective.²³ New technology may lead a firm into unfamiliar territory where it has little experience. And when the technical problems have been overcome, it is always possible that consumers are not interested in the new product which emerges. Some new products turn out to be too advanced for the existing market. Others may prove to be insufficiently superior to older products to command the kind of price needed to recoup the original investment.²⁴

New products fail more often than they succeed, and many different reasons have been given for their failure or success. Some writers find a major cause of either in the way product development is organized.²⁵ Extensive lists of reasons for failure have been produced which include everything from design and the nature of the product itself, through technical and manufacturing difficulties, to various factors related to selling, the market, price and competition.²⁶ Equally extensive lists have been given of reasons for success, including, particularly, factors related to the effectiveness of the product, knowledge of the market, skill in applying new technology, and in carrying out product development procedures.²⁷ A factor which receives acknowledgement in almost all of these studies is market orientation, that is, planning all stages of product development with reference to the needs of the market. But excellence in a particular area is insufficient to ensure new product success and it is generally more important for a firm to achieve a

satisfactory performance in all departments.²⁸

There remains, however, one unresolved problem with almost all of these studies: their failure to distinguish between more and less innovative new products. There is usually little or no attempt to deal with the questions of how innovative is a new product, and how does degree of innovativeness relate to success and failure. In what is probably the best attempt so far to deal with these questions, the approach is to relate different types of new product to clusters of factors which the analysis has found relevant to their success or failure.²⁹ Nine categories of "new product scenarios" are identified. These are summarized as follows:

1. **The better mousetrap with no marketing.** These were described as innovative products which offered definite advantages over other products. They involved the firm in new technologies and a new product class, but they tended to occur in firms with poor marketing skills. The result was a rather low success rate, 36%, as compared with an average success rate of 52% (see Table 3.1, next page) for all the new product categories in the sample.

2. **The innovative mousetrap that really wasn't better.** These were genuine innovations which failed to offer any advantage over other products. They were associated with firms which performed their product development activities badly, and had little knowledge of the rather poor market in which they were operating. All products in this category failed.

3. **The close to home "me too" product.** These were noninnovative products of average quality offering no economic advantage to the consumer. They "were not new to the firm, and were aimed at existing customers, utilized existing production facilities, relied on in-house technology, and involved familiar advertising/promotion methods".³¹ Production was efficiently organized, but marketing was weak. This was no great disadvantage, however, because the market was nondynamic, noncompetitive and dissatisfied. The result was a slightly above average

Category (cat. number)	% Successes	Number of cases
The synergistic "close to home" product (9)	72	25
The innovative superior product with no synergy (8)	70	20
The old but simple money saver (6)	70	30
The synergistic product that was new to the firm (7)	67	21
The innovative high technology product (4)	64	28
The close to home "me too" product (3)	56	16
The better mousetrap with no marketing (1)	36	14
The "me too" product with no technical/production synergy (5)	14	21
The innovative mousetrap that really wasn't better (2)	0	20
Total	52	195

Table 3.1. New Product Types Based on Cluster Analysis³⁰
(in descending order of successful outcomes)

success rate, 56%.

4. **The innovative high technology product.** These were innovative products, unique to the market and offered distinct advantages to the consumer compared with other products. They were technically complex, high priced and involved new technology, but production was well organized and marketing strong, with the result that their success rate was well above average, 64%.

5. **The "me too" product with no technical/production synergy.** These were similar to existing products and offered no special advantage to the consumer. Where they occurred, "There was a very poor company/product fit in the

areas of R & D, engineering and production".³² The technology required was new to the company, and product development activities were poorly carried out. The market was competitive and existing consumers were well satisfied. The result was a very poor success rate, 14%.

6. The old but simple money saver. These were simple, small, low technology products. They were familiar to the firm in terms of customer needs and product class. Their main advantage to the customer came in terms of lower cost, but they also offered small improvements (i.e., they were "marginally unique") which made them superior in meeting customer needs. Production was efficient but the market competitive. However, the advantage offered by these simple products gave them a high success rate, 70%.

7. The synergistic product that was new to the firm. These products were not just new to the firm, but involved new customers, new product class, new competitors and new production process. There was, however, a strong match between the product and the firm's capabilities, and particularly high efficiency in the way product development activities were carried out. Technology requirement was low and the product simple, but it offered advantages to the consumer and superior product quality. The success rate, 67%, was well above average.

8. The innovative superior product with no synergy. These were "breakthrough" products, technically complex and requiring a high level of technology. They were unique and superior, and offered cost and performance advantages to the consumer. The firms involved lacked synergy between technology and production, and between marketing and management, and were low in marketing knowledge and poor in financial analysis. The market, however, was only weakly competitive with the result that the products did well and achieved a high success rate, 70%.

9. The synergistic "close to home" product. Products in this category "were most notable for their similarity to the company's existing products and markets".³³ They involved high technology and offered the consumer

advantages as compared with other products, but they were neither unique, nor new to the company, "and kept the firm close to home in terms of product class, production process, technology used, distribution and salesforce, advertising and promotion, and competitors faced".³⁴ Product development activities were performed adequately rather than particularly well. The market was competitive and growing. This product category was the most successful of those studied with a success rate of 72%.

The importance of this study rests in the fact that it is almost the only one to examine in any detail the success and failure of different kinds of new product. It is of little help to know that the majority of new products fail. It is only slightly more helpful to know that firms which perform their product development activities more efficiently achieve a higher success rate with new products than others. This is no more than we would expect. But we can learn a great deal from evidence to the effect that new product success is related to the nature of the product and how it has been developed.

In this connection we find that of the more innovative new product categories, only two did well (4 & 8), while two did rather badly (1 & 2). And of the two categories judged noninnovative (3 & 5), one achieved average success while the vast majority of products in the other failed.

In comparison, the three moderately innovative categories (6, 7, & 9), all did very well. The most important factor in their success seems to have been the relationship of the new product to the firm's existing strengths. The products in question were old and familiar to the firm (6), new to the firm but having a strong match with the firm's capabilities (7), or "close to home" (9). In two of these categories (6 & 9), the products were familiar to the firm in terms of customer needs.

What these conclusions suggest is that the most successful way to innovate is to aim at markets in which the firm already has experience, to concentrate on products

which are already familiar to the firm and which require familiar technology, and to keep the level of innovation fairly low.

Some degree of innovation is necessary, however, but for the majority of firms, not too much. The least innovative product categories did least well. The more highly innovative did a little better, but nowhere near as well as the moderately innovative. Thus the most successful new products appear to be those that represent small gains. Such products are the easiest for firms to develop and market. They tend to consolidate existing markets, and, in that they usually involve little significant change in design, they strengthen the trend to standardization.

The trend then, far from being challenged by ideas and research related to product development, is in general supported by them. Successful innovation, except in those rare cases when an entirely new concept product is developed, is to a large extent a matter of going with the trend rather than working against it. Even in the generally accepted definition of new product—a product new to the firm—there is the suggestion that such a product need not be intrinsically new. Thus there is much apparent ambiguity in work on product development where new products are concerned—what is a new product if it is not really new?—but this may be less an ambiguity than a reflection of day-to-day commerce where most business is done by selling long-term standard products which have been little changed in principle for many years, and where it is recognised that new products should build on existing strengths rather than supplant them.

As we shall see in the next section, it is such products, those which have been available for some time or which have known capabilities, which are most likely to appeal to the majority of consumers.

The Consumer

Consumers are people who buy goods for their own use as against those who buy in the furtherance of business activities.³⁵ Buying itself is a simple activity, but a great deal can happen between the buyer's realization that he wants or needs to buy something and the act of buying. The consumer must make a decision and many things can influence that decision. The decision-making process may be influenced by the consumer's own experience,³⁶ the way his mind works,³⁷ his family,³⁸ the social groups he identifies with,³⁹ the mass media,⁴⁰ aspects of the proposed purchase such as price,⁴¹ and so on. Thus a purchase must usually be matched not only to particular needs and economic circumstances, but also to the purchaser's self-image and his sense of position in the world at large. Consequently, the degree to which a consumer is inclined to buy more or less innovative products is as likely to be related to his personal circumstances as to the product itself.

Early research on consumer innovativeness usually emphasized personality and social position. Consumers were divided into several categories of innovativeness ranging from the innovator, the first to adopt a new product, to the laggard, the last to do so. The innovator was characterized as "venturesome" and tending to seek "the hazardous, the rash, the daring, and the risky",⁴² while the laggard would usually base his purchases on past experience. There is an interesting relationship between the innovator and the laggard, in the suggestion that the innovator will often buy a new product simply because it is new, while the laggard will reject it for the same reason.⁴³

Between the innovator and the laggard, come various groups characterized by lesser degrees of innovativeness or conservatism. These represent the majority of consumers who, while willing to innovate to a degree, are more cautious and tend to take rather more trouble over the decision to purchase. Thus those in the category "early adopters" have been characterized as "respectable", the

"early majority" as "deliberate", and the "late majority" as skeptical".⁴⁴ A point often emphasized is the element of risk, not simply in terms of the financial loss which may result from a bad purchase, but in the social loss of face which may also arise. Those of average wealth particularly are seen as socially conformist and having a high need to maintain the material symbols of their station in life.

Various methods may be adopted to reduce the apparent risk in buying. Some consumers seek information about the product from advertising, friends, or reference groups, or they may seek to establish particular rules or routines to follow when undertaking a purchase, such as, for example, a self-imposed restriction on the use of credit cards, or a preference for plain, sensible designs.⁴⁵ Others may depend largely on brand loyalty,⁴⁶ or use price as an indicator of quality.⁴⁷

The wish to avoid or reduce risk and the tendency to routinize buying, will tend to militate against innovative behaviour. In the desire, which is widespread if not universal, to keep up with the Jones', most consumers are followers rather than leaders. In the American context, people identified as "middle majority"—a concept suggestive of the average consumer in an affluent society—have been characterized as wanting "solid results" in satisfying personal needs; results which match the individual's sense of his own worth. Economy is desired yet at the same time there is a willingness to pay "a higher price for genuine quality". Such people want "not radical departures from the past but products which help them reach smoothly the next step in self-fulfilment, be it a rose bush, a new sauce for the meat loaf, a cake mix with a more refined image".⁴⁸

The suggestion that the average consumer is rather conservative, gets further support elsewhere. The importance of personal characteristics and social class as indicators of consumer innovativeness, has been disputed by some researchers on the grounds that they are unimportant

as predictors of innovativeness.⁴⁹ In contrast, certain characteristics of the product are strong predictors. Among these, relative advantage and compatibility, that is, the correspondence of the product with existing values and past experience, are strong positive indicators, while complexity and perceived risk, are strong negative ones.⁵⁰

Of these factors, relative advantage, the advantage of a new product over others, is exclusive to the product and is obviously a characteristic of the product rather than the consumer. Compatibility, however, is hard to distinguish from the personal characteristics of the consumer, since, in that it refers to his own values and experience, it is as much related to him personally as to the product. Also, it is surprising that compatibility can be a good predictor of consumer innovativeness, since how innovative can a new product be if it must be compatible with the consumer's existing values and past experience? A radically new product will not serve if it clashes with the consumer's existing values. It would be reasonable to conclude then that the products which are successful because they are compatible, are those moderately innovative products which we have already found to be preferred by most consumers.

The negative innovation attributes, complexity and perceived risk, that is, the factors which will tend to deter the consumer from adopting a new product, also suggest limits on the degree to which new products can be innovative. The unknown is always risky compared to the known, and an increased degree of complexity will heighten the risk.

Thus, as we have seen elsewhere, new products which are to appeal readily to a consumer who does not belong to the fairly limited class of high innovators, must not be too radical in concept or design. The majority of consumers will tend to look for products which are improved, which offer some advantage over previous products, and yet which are familiar in basic form, design and performance. Anything which does not quite measure up to such standards,

and which appears to be a rather risky purchase, is likely to deter the majority of consumers at least in the short run. In the long run, almost any innovation might become widely adopted, but by then the more typical consumer will have had time to familiarise himself with it, either through advertising or through the experience of acquaintances. It will no longer be so new.

The effect of the tendency to caution on the part of the consumer particularly where new products are concerned, clearly encourages the trend to standardization. So long as consumers prefer products with which they are familiar and which are in line with their previous experience and existing values, at the expense of those which are more radically new and relatively unfamiliar, so long will producers find it expedient to develop new products mainly within an existing product format. The result will be the continuing tendency to standardize products on those basic designs which have already proved successful in the marketplace.

This conclusion does not mean that product innovation will never take place to more than a minimal extent. What it means is that the more innovative products will be unlikely to gain a substantial share of the market until they have been available for a considerable time, and certainly a longer period than would be required for many less innovative new products.

Conclusions to Chapters 2 and 3

The trend to standardization refers to the tendency over time for diverse entities to be formed into classes according to activity, function, or other factors of correspondence, and, within each class, to become more and more alike. It is in many ways an autonomous trend in that it is not governed by outside intervention or deliberate policy. But neither does it represent some supra-individual entity. Rather it is in the nature of a system or organizing factor in that it occurs through the operation of natural selection among biological organisms and comparable processes in human activities. These processes take the form of a tendency on the part of populations or people in general to seek the most efficient solutions to problems, and they are fostered by the gains which greater operational efficiency brings to those having to act in competitive situations.

Species tend to become subject to particular standards because by being so they maximise their efficiency as survivors. Human customs become established and standardized because they serve a purpose, they are functional in that they contribute to the survival of the community. Technologies tend to evolve into standard practices in the cause of greater efficiency since no one willingly works harder than he has to. Similarly, products tend to become standardized in the adoption of more efficient designs, but also because of economy in manufacturing, custom, habit, taste, fashion, and the gains to the producer or marketer from giving the consumer what he wants.

On the level of functional efficiency, the best design is that which performs a given task in the most satisfactory and effective way. It is almost inevitable that the producer will aim to develop better designs himself or to imitate and improve the better designs of his competitors. Thus it is to be anticipated that a good design will tend to drive out poorer designs, and develop into a widely adopted standard product.

In practice, however, there is often a discrepancy

between the best design to serve a given function and the widely adopted standard. This happens because there is much more to developing, manufacturing and marketing a successful product than the pure mechanics of design. A best design may be much more expensive than one which, although not quite so good, still performs reasonably well. Price, which usually reflects manufacturing cost, is a major factor in the marketability of a product. A lower price will often compensate the consumer for a product which is not quite as good as it might be. The low-priced "almost-as-good" product is likely to achieve much greater sales than the product of high-priced perfection. Thus from the producer's point of view it often pays to trade-off some degree of design efficiency for greater ease of manufacture and reduced costs.

It is in pursuit of these aims that the producer will tend to standardize production methods and product specifications even at the cost of some reduction in product performance. Thus production efficiency standardization will tend to shift the trend of design away from a sole emphasis on functional efficiency towards greater manufacturing convenience. But there is a limit to how far this process can go. Consumers will not buy a product simply because it is cheap. At the same time, few of them can afford to insist on the best irrespective of price. Thus the successful consumer product almost always represents a compromise between price and quality.

But there is more to satisfying the consumer than an appropriate combination of quality and price. The standardization of the market-place is the outcome of competition, the emphasis on what will sell. And what sells may reflect less quality or price than caution or inertia on the part of the consumer.

Consumers, if not necessarily conservative, are, in the main, cautious. Most of them will not readily adopt a radically new product. They will, on the contrary, tend to buy goods not very different from those they have bought before and with which they are already familiar. The least

known a new product is, the greater the risk would appear to be in purchasing it. After all, it may not work or the consumer may feel he has little need for what the new product can do, particularly when he has not experienced anything quite like it before.

This caution on the part of the consumer is not at all a bad thing from his point of view. New products often do fail to do what they are intended to do, and even when they work, they often provide services which few people have much use for.

Companies, therefore, are not to be condemned for pursuing a rather conservative new product policy. It is no good being radically innovative if nobody will buy the product. Companies have to make a profit; they have to make goods which sell. Many of them can do this best by being only moderately innovative and developing new products which meet consumers' expectations and do not deviate too much from existing standards.

Ultimately then it is the market which determines the standard product, which itself emerges as a compromise between functional efficiency, production efficiency and what the consumer wants. The degree of innovation that can be absorbed at any one time will be limited by these prior considerations.

The main aim of the thesis in its examination of the motor cycle industry, will be to analyse standardization as a trend which is apparent particularly in product development. The trend, although it may be influenced by policy, usually operates without conscious direction. Thus it develops not through the intentions of individuals but as a characteristic of a population, and, in a sense, the fact that an element of standardization is the result may appear to be fortuitous. An engineer does not develop a better engine for the sake of creating a new standard—for commercial reasons he may prefer to keep his product exclusive—but for the gains that result in terms of performance and efficiency. It only becomes a standard because others think it is worth copying. Thus in the chapters which

follow, the analysis will concentrate on the industry as a whole rather than individual firms.

In the next chapter, some of the theoretical ideas which have already been introduced will be developed further and used as the basis of a series of propositions which will be applied to the analysis of various phases in the development of the motor cycle industry.

CHAPTER 4

THE RESEARCH DESIGN

The purpose of the last two chapters was to define and analyse standardization and to show how it occurs much of the time unconsciously without the deliberate intervention of formal policy, and takes the form of a trend which is driven by the search for efficiency, and in which the more efficient solutions will tend to prevail even when they are not deliberately sought.

In this chapter the analysis is taken further so as to consider in more specific terms some issues related to the development of an industry. Three phases of an industry's early growth are defined: experimental, developmental and standardization. These are based on the development of the standard product which is analysed into its main characteristics. Finally, the various concepts developed so far are used as the basis of a series of propositions which are intended to assist the analysis and discussion which follows in the remaining chapters.

Introduction

If we treat arbitrary standardization as largely a subsection of production efficiency standardization, then product standardization can be divided into three main components: functional efficiency standardization (FES), production efficiency standardization (PES), and marketing efficiency standardization (MES).

In practice FES, PES and MES are almost always below current potential—their maximum theoretical level—because too much emphasis on any one will often conflict with performance in another. Thus the degree to which they are realised in the industry—what might be called the functional standard (FS), the production standard (PS), and the market standard (MS)—will almost always involve some

element of trade-off. The MS, which represents the kind of product with the largest proportion of the total market, will normally incorporate the most effective relative weightings of the other two factors (functional efficiency and production efficiency) for the achievement of profitable sales.

The variables FES, PES, MES, FS, PS, and MS, are indicators of activity within the industry as a whole rather than the individual firm. Thus they are largely independent of policy or personal intervention.

Standardization policy, and particularly policy within the firm, is beyond the intentions of the research. Certain individual firms, however, will be considered in connection with their products, and it may be possible to infer something about a firm's activities by comparing its product with the industry standard. But this kind of analysis will generally be used to back up the argument about the growth of the industry as a whole rather than to draw conclusions about the activities of firms.

The main aim of the research is to examine the growth of the industry in terms of the development of its product. This will be done by exploring the tendencies of the industry towards innovation and standardization, and ultimately by tracing the industry's progress towards the development of a standard product.

The Development of the Standard Product

For the purposes of analysis the development of the standard product (and by extension, the development of the industry) has been divided into three phases: experimental, developmental and standardization. This scheme bears some resemblance to that of Gaillard (1934) although his purpose is quite different.¹

The phases have been defined with reference to a preliminary survey of the motor cycle industry, the discussion on the development of other industries in Chapter 1, and some of the ideas of Chapter 3 together with related material.

The experimental phase consists of two distinct periods: pre-commercial and commercial, but concern here will be confined mainly to the latter which begins with the first commercial production. Products at this time usually fall far short of consumer expectations. Thus any standards which emerge as a result of widespread imitation, are premature, will be short-lived, and the products they represent will tend to fail commercially. So also will those which are more innovative, because of the high development costs for products which are still in some degree experimental—costs which will be difficult to recoup before the products are superseded. Thus although any product may sell in small quantities, few will be profitable and few firms will make much money.

The developmental phase is marked by the appearance of potential standards. Potential standards are innovative products which are sound enough in basic design to be capable with further development of becoming definitive standards.

Competition between the potential standards will eventually result in the emergence of one predominant design which will probably become the definitive standard at least as far as appearance is concerned. Other aspects of the developing standard like price and technology will be subordinate to the development of performance. Commercial success at this stage is problematic since even now the typical product will leave much to be desired for the majority of consumers.

The standardization phase begins with the appearance of the first definitive standard product. The latter emerges when the product of standard and by now conventional appearance has been sufficiently improved in performance to give it a widespread and more general appeal among actual and potential consumers alike. The result will be a rapid expansion in the market and an increasing degree of imitation of the standard model while untypical designs rapidly lose popularity. The standardization phase does not, however, mark the end of development but a change in

direction from the attempt to develop entirely new models to concentration on improving existing ones. Firms entering the industry at this time with a good quality product which imitates the definitive standard, can expect to make good profits.

While these phases are analytically distinct, they are not exclusively demarcated in time since there is bound to be some overlapping between them. Experiment will not end with the experimental phase and neither will development be complete with the beginning of the standardization phase. Both are likely to continue but are never again likely to be as predominant a characteristic of the industry as they once were, since once a standard product has emerged it is unlikely to be replaced except by another standard product.

The standard product is defined by its widespread adoption and popularity at the expense of other products. It is analysed in the following section.

Characteristics of The Standard Product

The standard product is likely to have four main characteristics:

1. A given price range usually within fairly narrow limits;
2. A conventional appearance and general format within narrow limits;
3. Familiar and generally accepted technology;
4. A widely accepted level of performance.

The standard price range is likely to be the first characteristic established—a result of the interaction between production cost and product market—followed later by appearance and general format, and last of all, the level of performance. (This conclusion is suggested by the concept of "potential standard" which is discussed below.) The development of appropriate technology is related to all of the others and has no obvious time-scale.

Only when a level of performance is achieved which is not less than that which the majority of consumers believe desirable, will anything approaching a definitive standard

be established and it is in these terms that the definitive standard will be defined. It requires a definitive standard to appeal to the average or typical consumer rather than the enthusiast alone, and therefore its development is likely to mark the beginnings of rapid growth in output and the consolidation of the industry.

New products which do not match up to the standard will eventually be rejected by the consumer unless, and then probably only in a few cases, they offer exceptional advantages as compared with the standard in terms of either:

- exceptionally low price
- or exceptionally attractive appearance which overcomes the consumer's preference for conventional appearance
- or exceptional performance.

If such a new product should succeed it could either replace the standard or become co-existent with it as an additional standard. There is no reason why there should not be more than one distinct standard product.

The development and emergence of a standard product is an important result of the trend to standardization. Taken together with the trend itself and its components, and the three phases of the industry's growth, it provides the basis of a number of propositions which can with profit be used as a guide to the research.

The Propositions

These propositions have been divided into three main classes: those concerned with the industry's long-term development, those related to the various phases of the standard product's development, and those concerning the product without reference to period.

A. Propositions about the development of the industry in general

1. As a new industry develops, product design across the industry as a whole tends to change from highly diverse—a multiplicity of different models—towards convergence

around one or a few standard types.

2. As a new industry develops, innovation tends to change from the more radical in character to the more conventional, such as improvements to standard models.

B. Propositions about Phase 1: The experimental period and premature standards

3. In the earliest days of an industry the only requirement to ensure the marketability of a product is that it works, however bad its performance may be.

This proposition is based on the idea of novelty. Few people will know much about a new concept product or have any idea of how it should perform. But provided it works some will buy it simply because it is new.

4. In order to survive for any length of time, a product must reach a certain minimum level of performance.

5. It will be difficult for earliest products to survive because new and better ones will soon be placed on the market.

6. When there are no satisfactory products from the consumer's point of view, even poor products may be widely imitated and become premature, but acknowledged, standards.

7. Premature standards which gain the loyalty of the consumer will be able to resist for a time competition from better products because of the typical consumer's tendency to caution.

C. Propositions about Phase 2: The developmental period and developing standards

8. During this period there will be at least as many different product designs as at any other period of the industry's development, but the number will diminish rapidly as producers begin to imitate the more commercially successful designs.

9. Competition between potential standards will eventually leave one dominant design in each product class. This will become the developing standard and will be widely imitated.

10. Products which diverge considerably from the developing standard in terms of price, appearance, basic technology or performance, may enjoy short-run success but will eventually become difficult to sell.

11. Products which deviate from developing standards may survive commercially if they offer the consumer compensation in nonstandard items.

D. Propositions about Phase 3: Standardization

12. The appearance of a definitive standard will intensify imitation and stimulate research on improving the standard model.

13. As the definitive standard becomes more entrenched, more innovative products will have to be increasingly outstanding in order to compete with it.

14. As the definitive standard becomes more sophisticated, it will be easier to compete with it by offering a similar but slightly inferior product at a lower price.

E. Propositions which relate to all phases and the product in general

15. Products which are innovative enough to diverge considerably from any existing standard, whether premature or otherwise, and whether in terms of price, appearance, basic technology or performance, may be difficult to sell initially even when they offer the consumer distinct advantages as compared with other products.

16. When any product that is recognised or recognisable as a standard has appeared on the market, the only ways to innovate successfully are either to imitate and improve on the standard or to develop something obviously superior in terms of price or performance.

17. Products are more likely to be imitated when they are based on simple or familiar technology.

18. Products based on new technology are more likely to remain exclusive.

19. New products which depart from the standard will be most successful commercially when they differ only in

terms of price or performance, will do less well when they differ in basic technology, and will do least well when they differ in appearance. In other words, it will be easier to trade off other factors in favour of price or performance than in favour of new technology or new appearance.

This chapter brings to an end the theoretical section of the thesis. Its aim has been to take further some of the concepts developed in Chapters 2 and 3 and to develop them into a series of propositions which can serve as a guide to the more substantive part of the research. The progress of the research so far is summarised and explained in the following review.

Review

The main problem of the research, as set out in Chapter 1, is to explain how the relatively diverse and innovative product make-up of the motor cycle industry in its earliest days first began to evolve into one that was rather more standardized and conventional.

The trend to standardization is a concept which provides a means of approaching this problem and finding a solution. In analysing the trend, three main factors, FES, PES and MES, have been identified which help to explain why product development will tend to move in one direction rather than another, and why the product itself will tend eventually to become standardized across the industry as a whole.

In considering the evolution of a standard product in the early days of an industry, three main phases have been suggested, experimental, developmental and standardization, which help to trace the development of the product from its first appearance in any form to its first realization as a definitive or relatively long-term standard.

The standard product itself has been defined and analysed into its main components so that it may be used as a measuring rod against which to evaluate less standard or

non-standard products.

Finally, these various concepts have been used as the basis for the development of a series of propositions which can help to guide the research in the direction intended.

The next five chapters, although largely empirical in nature, all owe much to the development of the thesis so far. Chapter 5 which follows this one and is largely background material in that it deals entirely with the development of the bicycle and the cycle industry, has been arranged as far as possible in accordance with the three phases of product development suggested above.

Chapter 6 has been organized in accordance with the concept of a pre-commercial experimental phase. Otherwise it is largely empirical as it has little use for the other concepts so far developed.

Chapter 7 is concerned with the first commercial production, the late experimental phase. Apart from the almost purely empirical section dealing with the general history of the industry, it has three main sections: the motor cycle as technical product, as consumer product, and the evaluation of the development of the product in terms of the propositions. The first of these, dealing with technical development, is concerned mainly with the functional efficiency of the machine and in effect refers back to FES. The second deals with the effectiveness of the motor cycle from the consumer point of view and refers back to MES. Evaluation of the product in terms of the propositions provides a more direct way of relating concept to data and integrating empirical and conceptual aspects of the research as a whole.

Chapters 8 and 9-12 as a single unit, follow much the same pattern as Chapter 7 while they deal in turn with the developmental and standardization phases.

The production element of the trend to standardization (PES) has been deliberately neglected mainly because there is little evidence that production methods had any significant effect on product design in the industry before the first world war.

CHAPTER 5

THE DEVELOPMENT OF THE BICYCLE

This chapter is devoted largely to a brief account of the technical development of the bicycle and the tricycle, failing which there could have been no motor cycles and no motor cycle industry. The discussion is organised as far as possible within a format comprising the three phases of product development, experimental, developmental, and standardization, presented in the last chapter. It covers the early experimental machines, the first commercial production, the high-wheelers, the tricycles, and the safety bicycle which but for its lack of an engine was the prototype of the early motor cycles. The cycle industry is referred to from time to time but no attempt is made to write its history in any detail.

The most important conclusion of this chapter is the great significance the development of a standard product had for the development and growth of the industry as a whole.

Introduction

The bicycle was a peculiarly nineteenth century development. The various forms of horse-drawn carriage and cart had a history going back thousands of years, but the single-track machine, despite its forerunners, was not developed into a practicable vehicle until the middle of the nineteenth century. Thus, it can be argued, it arrived only just in time, at least, that is, for the development of the motor cycle. If the bicycle had not been developed until thirty or forty years later, motor transport would initially have been reserved to "horseless carriages", and if it had not been developed at all, there would certainly have been no motor cycle. Thus the history of the development of the bicycle is in part also the history of the

motor cycle.

The first true bicycles,—“true” in the sense of being mechanically driven and not just pushed—to be produced in commercial quantities, were put on the market in the 1860s. These early machines were poor performers, however, and efforts continued to develop something better. Most of the models that followed during the next twenty years were largely experimental and fell short of what was desired—a safe machine which ordinary people could ride. The first effective “safety bicycle”, the prototype of the modern machine, was not developed until 1885, the year which marks the beginning of the developmental phase. The new design had become the acknowledged and widely adopted standard by the early 1890s. Thus the developmental phase was relatively short, particularly in comparison with the experimental phase, but then the idea of the bicycle or one-track vehicle is of considerable antiquity.

The Experimental Phase: Early Developments

The bicycle combines two different and quite distinct principles: propulsion by human muscular power and the one-track wheel arrangement which gives the vehicle stability only when in motion. The possibility of propulsion by human muscular power had been considered in pre-Christian times, and again during the middle ages.¹ For several centuries before the nineteenth, experiments were carried out and vehicles of various designs were built. One of the first of these, designed in 1418-19 by Giovanni Fontana, Rector of the Faculty of Arts at Padua, was a four-wheeled vehicle operated by the rider pulling on an endless rope running around a pulley which drove the rear wheels through gearing.²

The idea of a two-wheeled, one-track vehicle is of comparable antiquity. In Roman times there was a children's toy which resembled a two-wheeled scooter.³ A more curious example dates from 1580 and takes the form of a stained-glass window depicting a bicycle-like vehicle. The window was made in Italy and installed in the church at

Stoke Poges, Buckinghamshire,⁴ but it does not seem to have inspired contemporary design. The first vehicle resembling a bicycle which had any practical use, albeit rather limited, did not appear until 1791. It was known as a *célérifère* and was little more than a beam on wheels though sometimes it was constructed in the form of a horse. It was propelled by pushing with the feet.⁵ The *célérifère* was renamed *velocifère* in 1793 and was gradually improved by lighter beams and bigger wheels, but major improvements did not come until 1816 when the Baron von Drais de Sauerbrun built a machine with a steerable front wheel.⁶

The new machine which was known as the *Draisienne* soon became a craze. On one occasion a rider covered the 37 kilometres from Beaune to Dijon at a speed of 15kph,⁷ which suggests it could be quite useful for the more athletic individual. In England the *Draisienne*, renamed the hobby-horse or dandy-horse (fig. 5.1), achieved some popularity but soon went out of favour because of the ridicule of



Fig. 5.1. The Hobby Horse

cartoonists and the wear and tear on riders who were liable to develop hernias.

As a result, interest in two-wheelers waned and inventors turned their attention to three and four-wheeled machines. Among these were quadricycles operated on a pedal principle similar to the child's pedal car, but such vehicles did not prove to be very practicable.

Mechanical Propulsion

The first bicycle that could be ridden with the feet entirely off the ground—in effect the first true bicycle—was the invention of Kirkpatrick Macmillan, a Scottish blacksmith, and dates from 1839.⁸ Capable of 14mph, it was operated by a treadle suspended from the steering head and linked by connecting rods to cranks fitted to the rear axle (fig. 5.2). Thus it anticipated by forty years the rear wheel drive safety bicycle which would eventually become the universal standard. But despite its good performance and advanced design it aroused little but local interest and never went into commercial production, although it was produced in small quantities by imitators.⁹

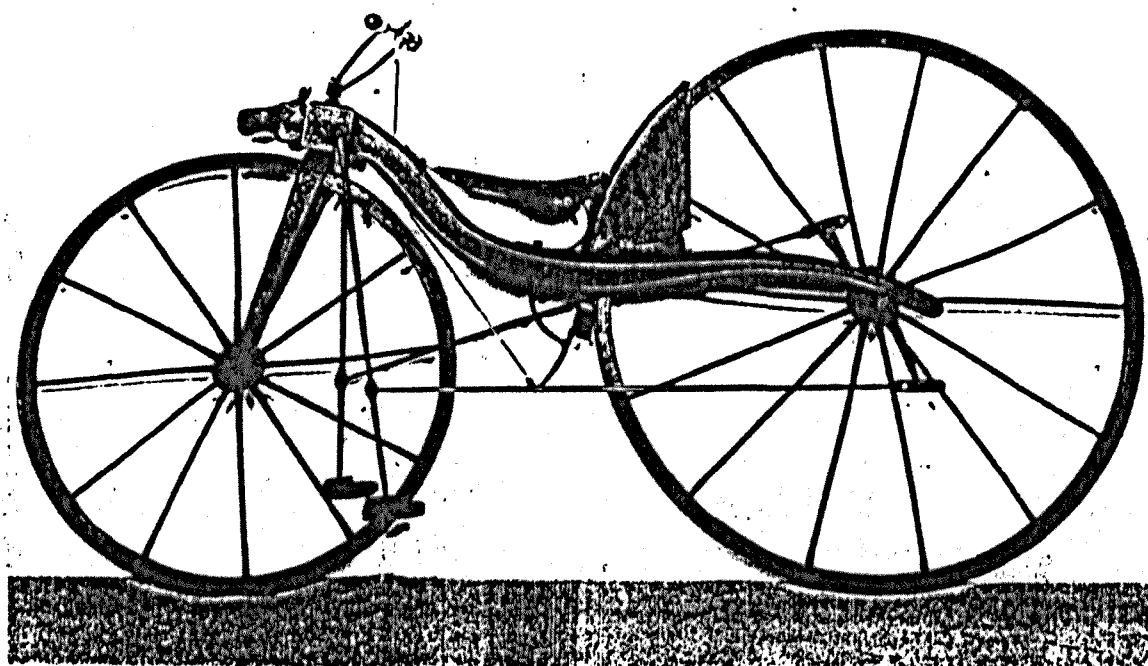


Fig. 5.2. Macmillan's Bicycle

This outcome was a major opportunity lost as there was to be no commercial production of a mechanically propelled bicycle for another twenty years. In 1861 a machine which bore no relationship to that of Macmillan, was invented by Pierre Michaux, a Parisian watch repairer and maker of perambulators. The velocipede, as it was called, was developed from an old draisienne which had been sent for repair.¹⁰ It was operated by pedals fitted to cranks attached to the hub of the front wheel (fig. 5.3). This method of propulsion was decidedly inferior in principle to that devised by Macmillan, but it was the most popular method used to drive bicycles for the next twenty years.

The new machine was constructed largely of iron including the diamond section frame, the wheel spokes and the flat iron tyres which were like those of wagon wheels. This made it very heavy, 59lbs, and awkward to ride. Even so it was put into production and was an immediate success with 142 machines produced in 1862 and an output of more

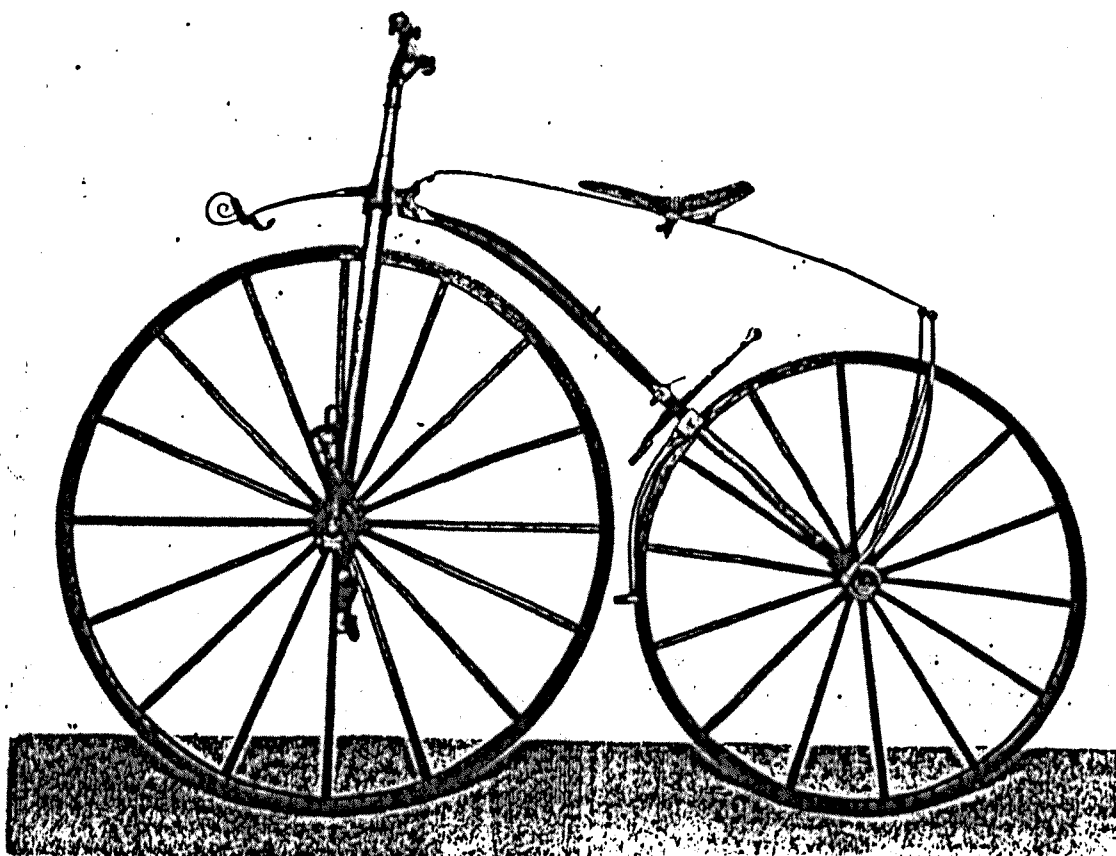


Fig. 5.3. The Michaux Bicycle

than 400 a year by 1865.¹¹

The velocipede soon began to interest English businessmen. In particular it interested the young Rowley Turner who was in Paris to study and also to act as agent for his uncle's firm. His uncle was Josiah Turner, one of the founders of the Coventry Sewing Machine Company, and when Rowley returned to Coventry in 1868 he brought with him orders for four hundred velocipedes which he hoped the company would manufacture. The company agreed and, renamed Coventry Machinists Company, began production of the machines, but their export to France was prevented by the Franco-Prussian War. The company met this set-back by developing the home market, where it achieved considerable success partly as a result of publicity stunts based on long-distance runs. The velocipede was soon firmly established in England becoming known as the "boneshaker".¹²

The High-Wheeled Bicycle

As its name would suggest, the boneshaker was a far from satisfactory machine, but it was soon to be improved, most notably by James Starley, one of the founders of the Coventry Sewing Machine Company and now foreman of Coventry Machinists. In 1870 Starley left Coventry Machinists and formed his own company with B. Smith and William Hilman. The outcome was the Ariel bicycle, the Starley design which set the pace in the development of high wheel bicycles.¹³

The Ariel (fig. 5.4) was both lighter and stronger than the boneshaker. Iron-spoked wheels gave way to much lighter ones with steel wire spokes under tension which could be adjusted as required. Solid rubber tyres replaced

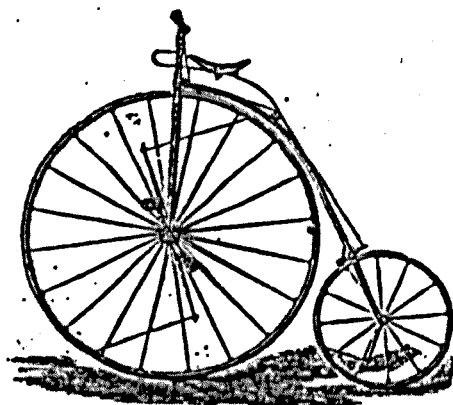


Fig. 5.4. The Ariel Bicycle
("The Bicycling Times",
24 May 1877)

the iron ones, and other modifications included an improved brake and a step for mounting. Patented in 1870 by Starley and Hilman, the Ariel had the large front and small rear wheel that we identify today with the penny-farthing, but in its day it was known as an "ordinary".¹⁴

Michaux had already begun to make the front wheel larger, and now Starley made it larger still. The large front wheel reduced rolling resistance,¹⁵ allowing greater speed and easier running especially over uneven ground. The small rear wheel acted mainly as a stabilizer and helped to keep the weight down. The Ariel was one of the most popular of the early high wheelers and, ridden by experts, such machines could reach well over 20mph.¹⁶

The 1870s marked the first period of substantial growth in the British cycle industry. In 1871 the number of firms in the industry has been estimated at about a dozen,¹⁷ yet by the mid-1870s there were about 50,000 bicycles on the roads of England and at least thirty firms making them. The main centres of manufacture were Coventry, Birmingham, Nottingham, Wolverhampton, Sheffield and Cheltenham.¹⁸ By 1879 at least sixty firms had entered the industry and between them were producing three hundred different models.¹⁹

The high-wheeled bicycle remained popular for about twenty years, but it was neither particularly safe nor easy to ride and was rarely without its critics. The rider's position, almost directly over the centre of the front wheel, was precarious and he could easily be thrown over the handle-bars.²⁰ Experiments began in the mid-1870s to construct a safer machine, one that would place the rider both lower and more centrally between the wheels. Two different solutions were attempted: the tricycle and the "safety bicycle". The tricycle was the easier and more obvious solution.

The Tricycles

For several years the tricycle was the main alternative to the high-wheeled bicycle. Many different tricycles were produced some of which would look very strange by modern standards. But from the appearance of the first commercially manufactured machine, the Dublin tricycle of 1876, it was little more than ten years before the tricycle began to approach something like its "modern" form. The Dublin tricycle was propelled by treadles acting through a system of levers to drive the large rear wheel. It was steered by the two small front wheels.²¹

Some other designs had two large driving wheels, with the small steering wheel being sometimes in the front and sometimes behind. One of James Starley's designs, the Coventry tricycle had the single, large driving wheel on one side and the two small steering wheels on the other side, one in advance of the driving wheel and the other behind it (fig. 5.5). Patented in 1876, it was the most successful of the single-driving tricycles.²²

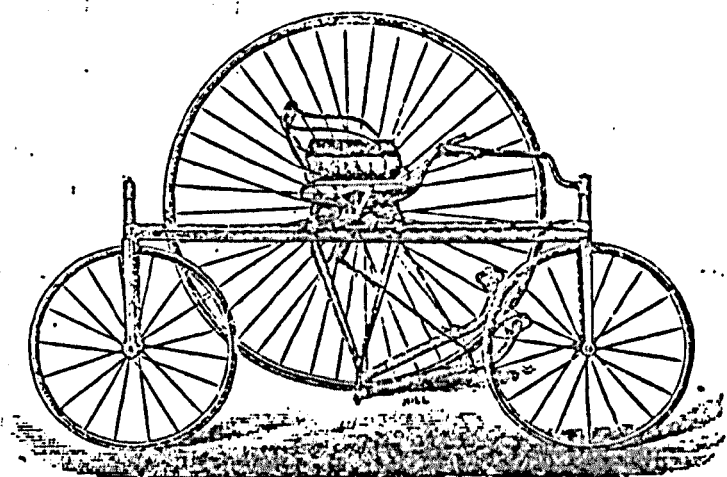


Fig. 5.5. The Coventry Tricycle
("The Bicycling Times", 7 June 1877)

But probably the most important invention to come out of the work on tricycles was James Starley's differential gear of 1878. A problem with two-wheel drive tricycles was that when turning, the wheel on the inside of the turn would remain almost stationary while only the outer wheel was driven. To overcome this effect, Starley devised a gear which allowed both wheels to take an equal share of the driving power irrespective of the course the machine

was travelling.²³ His differential gear originated a principle which has since been applied to all motor vehicles with two-wheel drive, but the more immediate effect of his invention was to establish the superiority of the two-wheel-drive tricycle.²⁴

The prototype of the "modern" tricycle first appeared in 1884 in the form of the Humber "Cripper", which had pedal-operated chain drive to the two rear wheels and a single centrally placed front steering wheel. the Ripper had a particularly good performance and was named after Robert Ripper, a professional rider who won many races on it.²⁵ But in its fully developed form (fig. 5.6), the

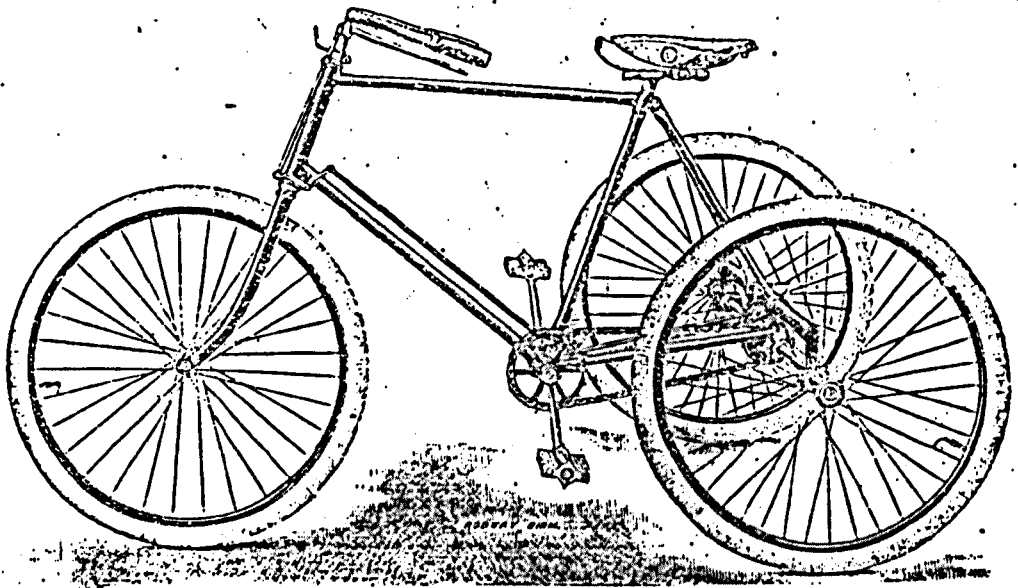


Fig. 5.6. The Sparkbrook Tricycle
("The Cyclist", 28 November, 1894)

tricycle was to become of greater importance to the developing motor cycle industry than to cycling where it was about to be superseded by the safety bicycle.

The Safety Bicycle: The First Step to Standardization

Not everybody approved of the tricycle. Many thought it a machine for "elderly gentlemen, ladies and timid persons",²⁶ and development work on the safety bicycle continued. First attempts aimed to reduce the size of the

front wheel, but this approach could achieve little on its own and more radical modifications were introduced. The most important innovation was the shift from front to rear wheel drive in which the power was transmitted by chain from pedals placed between the two wheels.

The best known of the earlier attempts to develop a safety bicycle was the invention in 1879 by H.J. Lawson of his "Bicyclette", which was still rather like the ordinary with 40 inch front wheel and 24 inch rear. It was perhaps ahead of its time, but it was not apparently a very good design and it failed commercially.²⁷

Better designs followed, however, and early in 1885 there appeared the first "Rover" safety bicycle designed by John Kemp Starley, the nephew of James Starley who had died in 1881. Later that year a much improved model was introduced which approximated for the first time the modern diamond frame bicycle (fig. 5.7).²⁸

The development of the Rover marked the end of the experimental phase in the cycle industry. It would no

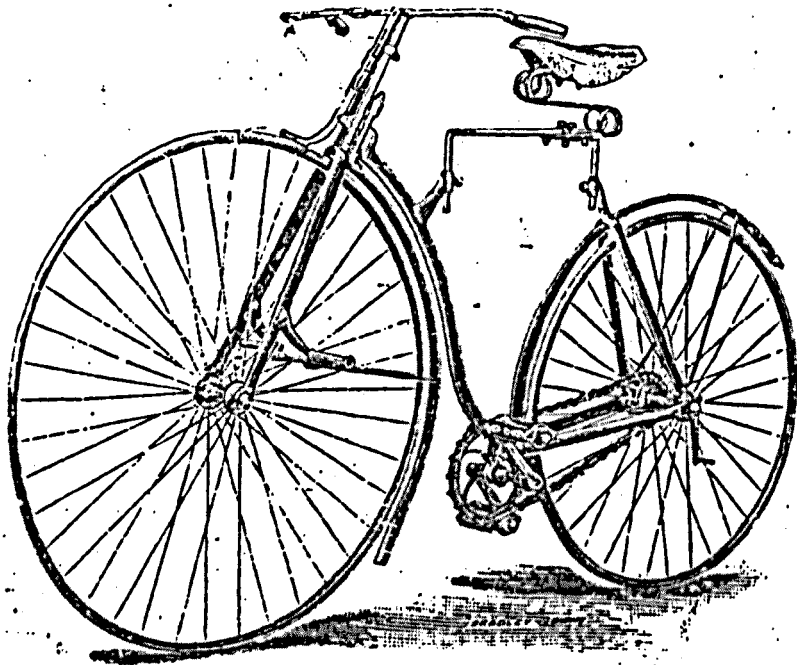


Fig. 5.7. The Rover Safety Bicycle of July 1885
("The Cyclist", 6 November 1901)

longer be necessary to develop radically new models in the search for an effective bicycle. The Rover had shown the way and from now on new machines would be developed along similar lines.

The Rover was the first potential standard bicycle in that it promised to be good enough to satisfy the majority of cyclists. Thus its appearance on the scene marked the beginning of the developmental phase even though it can be argued that this had begun earlier with the first rear wheel drive safety bicycles dating from 1879. The latter were not so good, however, to preclude further radical experiment, nor were they good enough to achieve the smallest degree of commercial success. The earlier date therefore is rejected.

Standardization and its Consequences

There is little more that need be said here about the development of the bicycle. The diamond frame safety bicycle was the most popular design from 1887 onwards,²⁹ and in time would replace most others. The development of pneumatic tyres in 1888 increased its popularity and by the 1890s the high-wheeled ordinary had become a thing of ridicule. Other new designs were still to appear like, for example, the fully triangulated, ultra lightweight model patented by Mikael Pedersen in 1893,³⁰ but they would not seriously challenge the popularity of the standard diamond frame machines until the development of the small-wheeled Moulton bicycle of the 1960s. And when, after 1896, motor cycle production began, most two-wheeled machines were based on the diamond frame bicycle.

The standardization phase of the industry's development dates from about 1889. In that year, it was observed with reference to "safeties" at the cycle show, "So far as these were concerned there was not much change from last year, except in a few details. This points to the fact that the age of novelty is passed for the present, and we think wisely that makers are devoting more attention to the perfection of known types rather than encouraging new

ideas, which may or may not be of value".³¹ By 1893 the bicycle (fig. 5.8) was not very different from the modern machine.

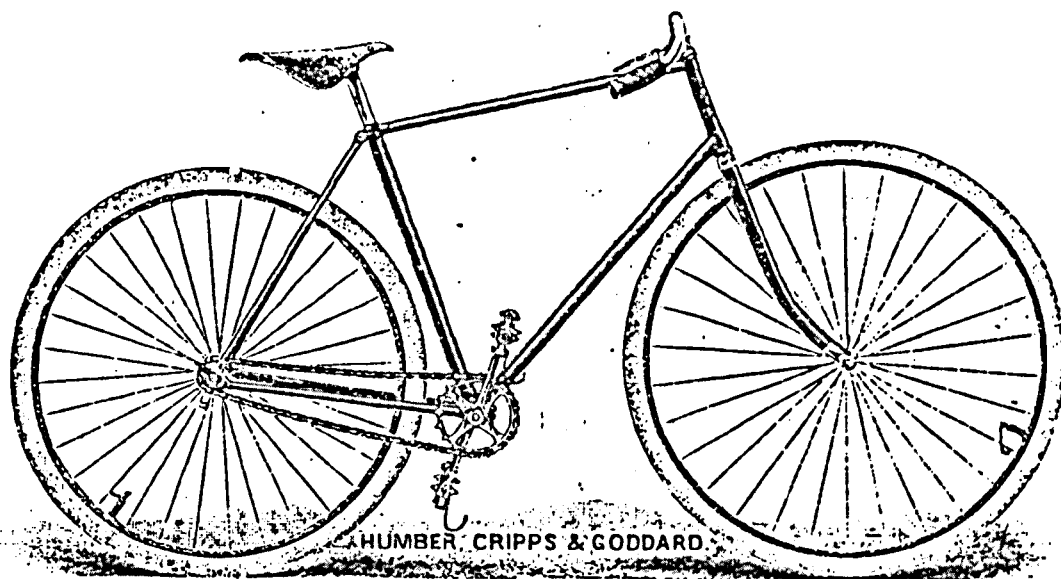


Fig. 5.8. Humber, Cripps & Goddard Bicycle
("The Cyclist", 8 March 1893)

The development of a standard bicycle acted as a major stimulus to the growth of the industry.³² Manufacturers now had a model which they could and did imitate, confident that here was a machine with a widespread appeal. By 1895, the boom year for the cycle industry, hundreds of firms were producing bicycles and the number of cyclists in the United Kingdom was estimated at one and a half million.³³

But the following year saw a slump in the industry as many firms had overreached themselves. The situation in the home market was aggravated by overseas competition which challenged the high priced, high quality goods characteristic of the British industry with an inferior, but cheaper, mass-produced product. In order to meet the challenge, British firms were compelled to adopt more modern production methods. Some succeeded, many failed, with the result that the number of firms in the industry declined substantially: in Birmingham from 309 in 1897 to 160 in

1913, and in Coventry from 75 in 1897 to 49 in 1912.³⁴ These difficulties for the cycle industry were, however, to the advantage of the new motor industries. With cycle manufacture no longer as attractive as it used to be, many firms turned their attention to motor cars or motor cycles.

Conclusions

The principles on which the bicycle was based emerged only after hundreds of years of experiment, but the first machine to resemble even remotely the bicycle as we know it today was not developed until the end of the eighteenth century. It was fifty years more before a mechanically propelled machine was developed, and twenty years beyond that before production began on a commercial scale. Even then experiment had to continue for another twenty years since the volicipede or boneshaker and the high-wheeled bicycles which were derived from it, were hardly comfortable or safe enough to appeal to more than a fraction of the potential market.

Not until the 1880s was a machine developed that could be looked on as a potential standard. This was the Rover safety bicycle, the principles of which were taken up so rapidly by other manufacturers, that within five years it had been developed into the standard model for the whole industry.

The success of the Rover was initially a technical one. The new machine solved various design problems which had been studied for several years, and established a format which was to prove not just a promise for the future but a prototype—it worked, it performed well, it succeeded commercially, it was copied, and beyond, it was developed further until there was little more to be done to it but relatively minor detail improvements. All this took place within the space of about five years.

The developmental phase then was very short especially when compared with the long experimental phase which preceded it, but this is in no way surprising. The difference is accounted for by two factors: (1) the long period

of trial and error during the experimental phase before a potential standard was developed, and (2) the concentration of practically the whole industry on developing and improving the potential standard once it had appeared, in contrast to the dispersal of effort during the experimental phase.

The experimental phase was a long one and almost bound to be so, because it could not be brought to an end except by the invention of a radically new principle of transport plus the development of that principle into a commercially viable product. The placing of such a machine on the market was what the whole industry had been waiting for for about twenty years. It was no surprise therefore that manufacturers wasted no time in developing it further with the result that a highly standardized version soon appeared.

The standard safety bicycle has proved remarkably long-lived and is still the most popular model one hundred years after the first Rover was put on the market.

The development of the standard machine initiated the cycle industry's take-off into its most rapid period of growth, and for that reason was almost certainly the most important event in its entire history. So long as manufacturers were committed to producing expensive and rather improbable machines in the form of the dangerous high-wheeler, the rather cumbersome tricycle, or experimental and entirely untried models, the industry's future prospects remained uncertain and its growth limited.

But once a machine had been developed which was safe and easy to ride, and neither difficult nor expensive to manufacture, the outlook changed completely. From then on and for many years to come, competition in the cycle industry would be mainly a result of new and improved production methods rather than the development of new designs, and it would be possible to introduce mass production technology which would reduce costs to the manufacturer and prices to the consumer thus bringing the bicycle within reach of an ever increasing section of the community.

CHAPTER 6

THE EXPERIMENTAL PHASE (1): THE MOTOR CYCLE, 1869-1893

As we saw in the last chapter, the first commercial production of a mechanically-propelled bicycle took place in the 1860s. It was only a very few years later and long before the development of the safety bicycle, that the first motor bicycle, a steam powered machine, was taken out on the road. This was the first of many experimental motor cycles which were developed during the twenty-five years before the beginnings of commercial production.

In this chapter several of these machines are discussed, some of them in detail, with reference to the parts played by both steam and the internal combustion engine in the development of the motor cycle.

The main body of the chapter is followed by an appendix on the definition of a motor cycle, the purpose of which is to indicate how motor cycles were distinguished from motor cars, a matter which is of some relevance to this and following chapters.

Introduction

By 1862 when Pierre Michaux began to produce his pedal-driven velocipede in quantity, there already existed three sources of mechanical power which might with further development be adapted to propel a bicycle. The massive and rather inefficient steam engines of the eighteenth century had been improved and reduced in size. In the early nineteenth century they had been installed in road going carriages and with further miniaturization might be suitable to power motor cycles. Lenoir's slow, inefficient gas engine of 1859 was already in production for stationary use. With the application of theoretical work already under way, such engines could soon be transformed into smaller, but far more powerful units. Electric motors had

been used to drive experimental vehicles as early as the 1830s, and with improved batteries might soon become a practical proposition for all kinds of vehicles. Which of these, steam, the gas engine, or electricity, was likely to prove most suitable to power a motor cycle was a matter for experiment. The first to be tried was steam.

Steam Motor Cycles

Steam was the oldest form of mechanical power and the most highly developed, and it is not surprising therefore that the first motor cycles should have been steam powered. The first two of such machines of which something is known, one made in France and the other, America, are both usually dated 1869. The French machine (fig. 6.1) was the result of a joint effort by Pierre Michaux himself, and L.G. Perreaux. It consisted of an extremely compact engine developed by Perreaux and installed in a Michaux velocipede. The engine was double-acting, had a single cylinder, steel piston and two flywheels. The multi-tube boiler was

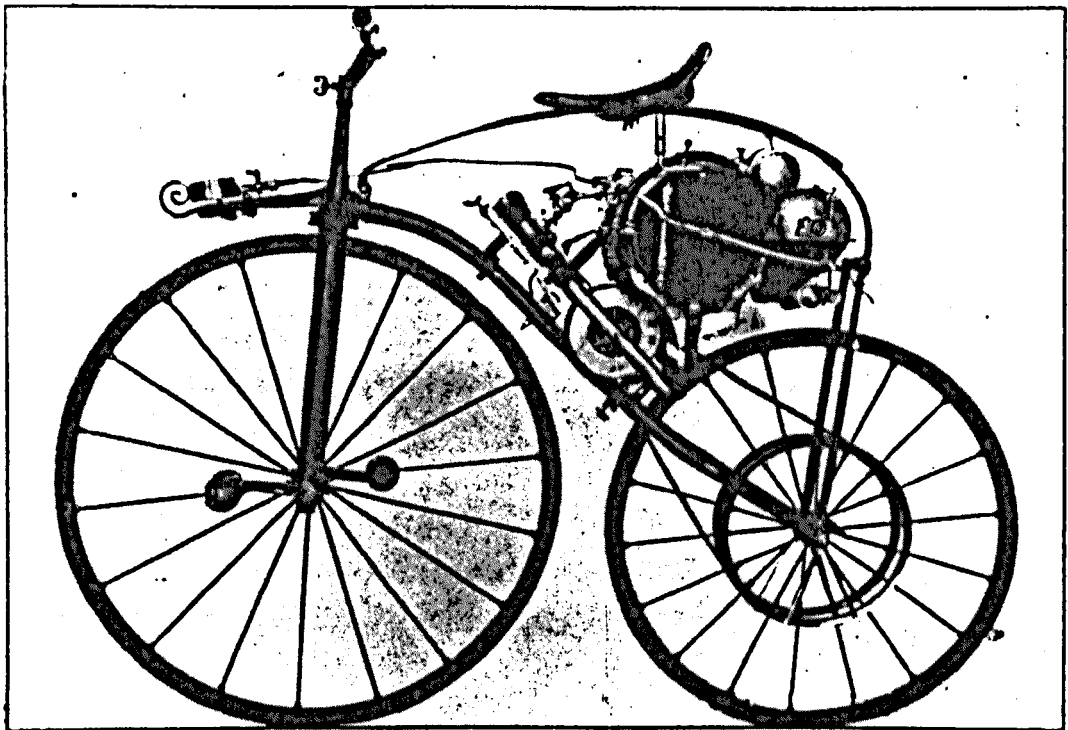


Fig. 6.1. The Michaux-Perreaux Steam Motor Bicycle of 1869

fired by alcohol-fueled burners.¹ Performance was good with a claimed speed of 15kph, but range was limited as the water carried was soon used up, and even then the machine was not really practicable since the high-placed engine made it rather unstable.

The American machine was constructed by Sylvester Howard Roper, who, according to at least one source, had been constructing steam cycles since 1865.² It was based on an American bicycle built by the Hanlon brothers and not unlike that of Michaux, but the engine was rather different consisting of twin oscillating cylinders which drove the rear wheel by connecting rods and cranks as in a locomotive. The boiler was heated by a charcoal fire.³ The result was a machine which differed from the Michaux-Perreaux in appearance but was of comparable performance and limitations.

Both of these machines were successful as experiments but neither offered any prospect of commercial exploitation, and work on two-wheelers was abandoned for a time in favour of three or four wheeled machines. The next Michaux-Perreaux machine was a steam tricycle, while Roper turned to four wheels, but little more seems to have been achieved by these early pioneers.

Experimentation continued, however, and in 1877 a Mr Meek of Newcastle-on-Tyne built a steam tricycle which was reported to have worked well.⁴ This was followed in 1881 by a much more important machine, also a steam tricycle, designed by Sir Thomas Parkins and constructed by A.H. Bateman. It consisted of an efficient twin-cylinder, double-acting steam engine installed in a Cheylesmore pedal-tricycle. Steam was supplied by a boiler fired by 21 petroleum burners.⁵ The machine was demonstrated successfully at the Stanley Cycle Show and a considerable number of orders was received for it, but it could not be produced commercially because the Locomotive Acts made operating such machines on the road impracticable.

The most important of the Locomotive Acts, that of 1865, had limited the speed of "locomotives" on the road to

4mph on the highway and 2mph in towns, and would not be repealed until 1896. Thus the development of motor vehicles in the United Kingdom was to remain for some time little more than an academic exercise. Any significant advance therefore was likely to come from overseas, either the USA or continental Europe.

The first steam tricycle to be produced in any quantity was the work of L.D. Copeland of Philadelphia. Copeland began in 1884 by fitting a steam engine to an American high-wheeled bicycle, but then turned his attention to tricycles. He built about 200 in all,⁶ possibly the first commercial production of any kind of motor cycle, although it is doubtful that such machines could have been a sound commercial proposition.

Elsewhere, efforts were still entirely experimental including models by Count Albert de Dion in 1887 and Leon Serpollet in 1888. By the early 1890s, however, steam cycles were so vastly improved in design and performance that they might soon have become commercially feasible, but this was prevented by the development of reasonably effective motor cycles powered by internal combustion engines.

At the same time as inventors were working on motor vehicles powered by steam and even before the development of the internal combustion engine, there were attempts to construct a practical electric powered vehicle.

Electric Motors

The electric motor was invented by Michael Faraday in 1821, and the first attempts to build an electric motor vehicle date from the 1830s.

As early as 1837 Robert Davidson of Aberdeen built an electric carriage powered by crude iron-zinc batteries and a simple electric motor.⁷ After that, interest in electric vehicles waned until the storage battery, invented by Planté in 1859-60, was improved by Camille Faure in 1881. This made electric vehicles practicable and in the same year an electric tricycle, fueled by Planté cells, was driven in Paris.⁸ Various electric vehicles

were built from then onwards including a number of tri-cycles, one of which was the work of J.K. Starley.⁹

There were few experiments with electric two-wheelers since the weight of the batteries made them unsuitable for most purposes, but electric tandems were produced commercially for pacing in cycle races in the late 1890s. By then, however, the internal combustion engine had come into its own and such vehicles were short-lived.

The Internal Combustion Engine

The internal combustion engine had a long development history. The concept originated from early studies in "the usage of a piston as a means of utilizing heat and pressure",¹⁰ and some of the early experiments were carried out by Huygens in 1680 and Papin in 1690. But it was another hundred years before something like a complete engine appeared with such examples as Street's "explosion engine" on 1784, and George Cayley's "gunpowder engine" of 1808.¹¹

Neither of these was ever commercially produced, but from then on there was increasing interest in the idea and progress was more rapid. During the next fifty years or so, most of the elements of the internal combustion engine were developed including "the ignition systems, at first flame ignition and later electrical spark ignition; compression of the explosive mixture; water cooling of cylinder and pistons".¹²

In 1859 Lenoir simply by applying existing knowledge, was able to construct a practicable engine for stationary use capable of generating up to 3 horsepower. It was fueled by coal gas, the gas-and-air mixture being drawn into the cylinder for the first half of the outward stroke and then fired by an electric spark. The expansion caused by the explosion drove the piston to complete its stroke. But without initial compression the engine was inefficient and uneconomical. It could, however, be maintained by unskilled labour and it soon came into widespread use.¹³

Important developments soon followed which promised to

make the internal combustion engine a far better proposition. In 1861 Schmidt developed the idea of compression, and in 1862 Beau de Rochas laid the theoretical foundations of the four stroke cycle. The majority of internal combustion engines are based on this cycle which is as follows:

1. intake of gas during outward stroke of piston;
2. compression by inward stroke;
3. ignition at dead point and expansion to produce power of outward stroke;
4. exhaust by second inward stroke to expel burned gases.¹⁴

It was 1876, however, before the first four stroke engine was developed by Otto and Langen of Deutz. It ran on coal gas and was marketed for stationary use only, and would have been too cumbersome to install in a motor vehicle especially in view of its size and the quantity of gas which would have had to be carried. The possible solution was to use liquid fuel, an idea which interested Gottlieb Daimler and Wilhelm Maybach, employees of Otto and Langen. It did not interest their employers, however, and they left the Deutz company in 1882 in order to develop the project on their own.¹⁵

By 1884 they had constructed their first engine. It was of 246cc capacity, and was capable of up to 800rpm which was very much faster than the stationary engines from which it had been derived. It generated about $\frac{1}{2}$ hp.

Technically, the engine was an interesting mixture of old and new features. It had two flywheels, one each side of the crankshaft, and the whole unit was enclosed in a cast aluminium crankcase. Cooling was achieved by a fan wheel which circulated air within a jacket enclosing the cylinder. The inlet valve was operated by suction of the piston and placed directly above the cam-operated exhaust valve. Ignition was by "hot tube". This consisted of a platinum tube inserted into the cylinder close to the inlet valve. It was operated by heating the tube externally by a spirit lamp until it was hot enough to ignite the explosive mixture in the cylinder. The carburettor was of "float"

type devised by Maybach.¹⁶

In the following year, 1885, the engine was slightly modified and installed in a two-wheeled machine designed solely to act as a test-bed for its application to road use. The machine, named "Einspur" or one track (fig. 5.2),

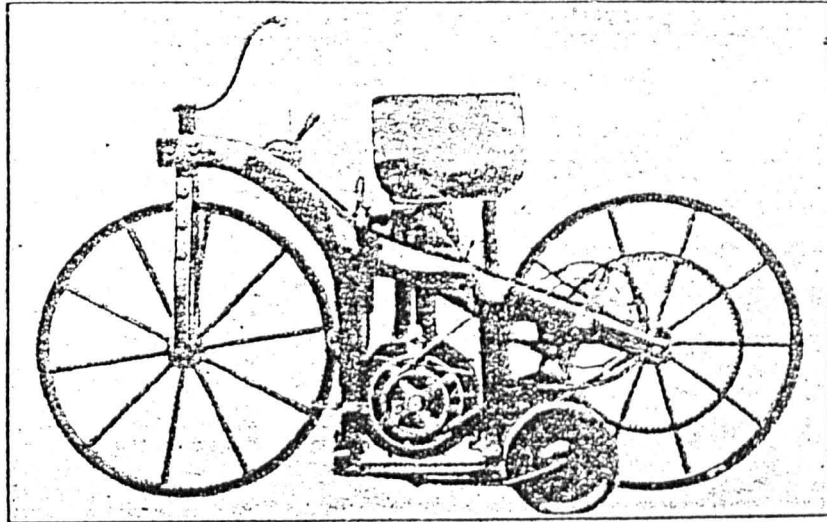


Fig. 6.2. Daimler's "Einspur" of 1885: The First Internal Combustion Engine Motor Bicycle ("Motor Cycling", 7 February 1911)

was constructed largely of wood with iron-tired, wooden-spoked carriage-type wheels. There were two, additional wheels which helped to stabilize it when stationary but could be raised when in motion. Transmission was by a leather belt from a pulley on the crankcase to the rear wheel. For normal running the belt was tightened by a jockey pulley which acted as a primitive clutch. Operating the brake would also loosen the belt and effectively disengage the engine. The engine itself was centrally mounted low down between the two main wheels, and the rider sat above it on a saddle shaped to resemble the back of a horse.¹⁷

The Einspur performed well. On one occasion Paul Daimler, son of Gottlieb, rode it from Canstatt to Unterturkheim and back, a journey of seven and half miles, during which the saddle was set on fire by the hot

engine.¹⁸ Such problems could have been overcome, however, but the project was soon dropped in favour of developing a motor car.

While Daimler and Maybach were building their first engine, Edward Butler, an Englishman barely into his twenties, was designing a motor tricycle. The design was patented as the "Velocycle" in 1884, and displayed at the Stanley Cycle Show. It took the form of many later tri-cars, steered by the front wheels and driven by the single rear wheel. It had a two-stroke engine, mechanically operated valves, and two water-cooled cylinders. Transmission was locomotive style with direct drive from the piston rods to overhung cranks on the hub; ignition was electrical with the spark generated by a Whimshurst machine; and the carburettor was of surface type.

It took Butler three years to obtain the financial backing he needed to build his machine. The first model, named the "Petrol-Cycle" (fig. 5.3), was completed in

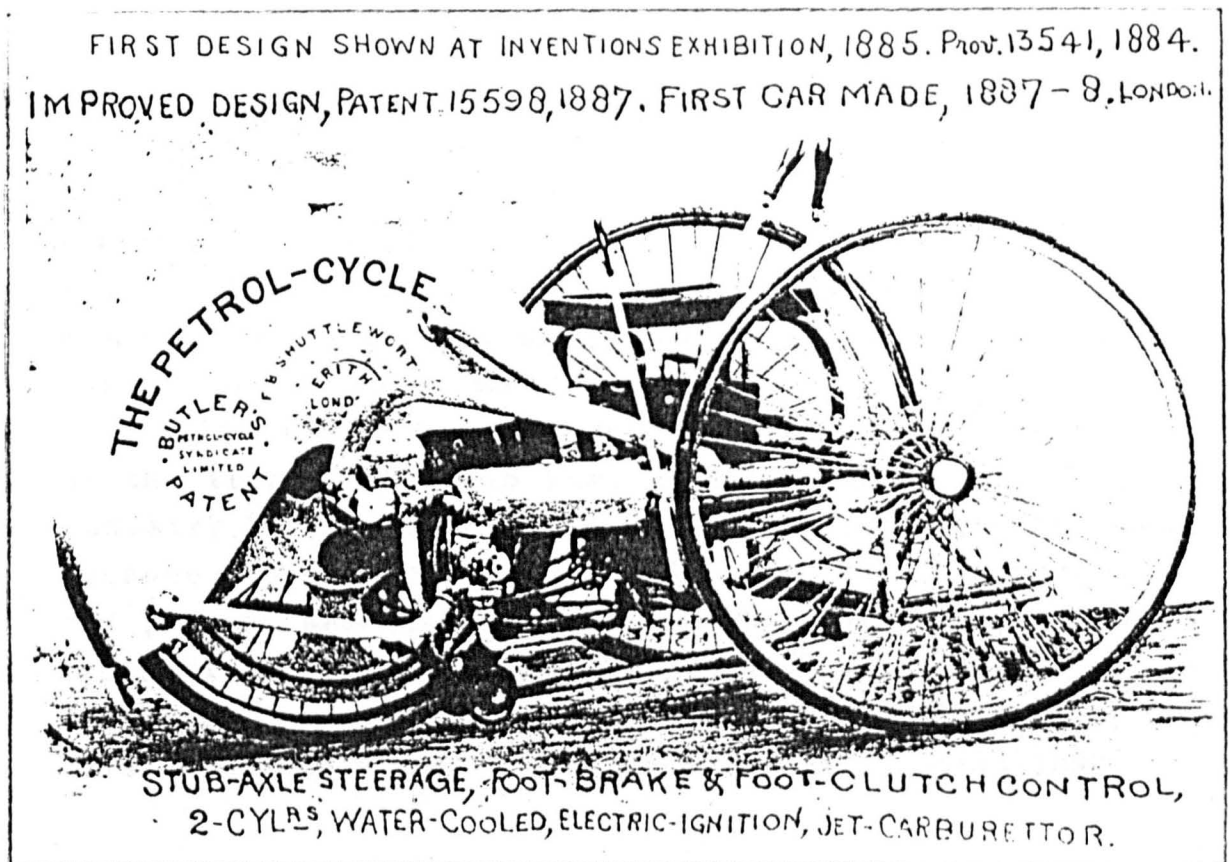


Fig. 6.3. Butler's "Petrol-Cycle"

1888. After testing it, Butler made further improvements so that eventually the machine had a float-feed carburettor of advanced design, ignition by Ruhmkorff coil and battery, a new four-stroke engine, and epicyclic gearing to replace the direct drive. Performance was now much improved and under test a speed of 12mph was achieved.¹⁹

But while technical difficulties were being overcome new ones began to arise including the problem of trying the machine on the road at a time when the Locomotive Acts limited speed to walking pace. As a result it was decided to concentrate on developing the engine for motor boats and industrial applications, but soon the money available to Butler from his backers was used up and the project was abandoned.

By 1890 both the bicycle and the tricycle had evolved into their standard forms which must have encouraged efforts to construct motor cycles. In the years immediately preceding the first production of motor cycles on a commercial scale in 1894, there were many experimental designs. One of the most interesting of these was a motor tricycle constructed by J.D. Roots in 1892. It was based on a standard tricycle and had a rear mounted, water-cooled, two-stroke, oil engine which drove the rear axle through bevel and pinion gears. The oil fuel was preheated and mixed with air, and after compression in the crankcase was ignited by a hot tube. Cooling water was circulated through the tubes of the frame.²⁰

This machine has been described as the "true ancestor" of the tricycles which dominated the early motor cycle industry,²¹ but it could not be used on British roads because of the Locomotive Acts. But for the Acts, this and perhaps several other British designs might have been produced commercially some years before commercial production first took place overseas. Instead, production of the first completely British design had to wait until 1898.

Experimentation and Continuity

As this chapter has been mainly concerned with the history of experiments in the development of the motor cycle, it has concentrated on technical issues. It does raise, however, a number of more general questions.

One of the most remarkable things about the pre-commercial experimental period, was not just the wide range of substantially different designs that were tried, but the fact that there was little sign of continuity, that is, of building on the advances made in previous models. Thus we find that Lenoir used a primitive form of electric ignition in 1859, but more than twenty years later, Daimler preferred the hot tube. The reason that has been given for this is that Daimler was uncertain whether his engine would work effectively with electric ignition.²² It certainly would have, however, and so we are left to wonder why he did not find out this for himself experimentally.

Butler had no such doubts and all of his models had a form of electric ignition. Yet several years after Butler's experimental success, Roots preferred hot tube. Most other elements of these designs also differed from each other, including the engines, the transmission systems, and the type of frame.

This lack of continuity would be more understandable if none of the early designs was in any way practicable, but this was not so. Even the Michaux-Perreux steam cycle has been considered a practicable machine for the time it was developed.²³

There were various probable causes. The first and probably the most important, was the ignorance of inventors about how the new technologies being developed elsewhere worked, hence the preference mentioned above of some experimenters for hot tube ignition when electrical systems were already available.

The second and possibly no less important was that the experimenters were almost always individuals or small firms with very limited resources. Thus if experiments did not produce quick returns they were likely to be abandoned.

Butler had no funds of his own and was able to construct his machine only after others had put up the money. When the money had been used up the project had to be abandoned.

Another was that bicycles, tricycles, engines and other related technologies, were still subject to experiment so that it was never certain which model might prove to be the better idea. The high wheeled bicycle was an absurd vehicle for powered propulsion and it is not surprising that experiments on such vehicles were soon abandoned.

A fourth cause was the question of patents although a clever inventor might defeat a patent by applying the new principle in a slightly different way. Otto and Langen on producing their four-stroke engine in 1876 took out a patent which was considered valid until it was discovered that Beau de Rochas had patented the four stroke principle back in 1862,²⁴ and this was why Butler's first design was for a two-stroke engine and not a four-stroke.

A fifth was that even after the development of internal combustion engines, most experimenters were still largely concerned with steam and one or two with electricity. Steam looked attractive as far more was known about it than internal combustion engines, but it required rather more development to make it practicable for motor cycles than the latter. The internal combustion engine was late in coming but when it appeared it caught up rapidly to steam and soon overhauled it, bringing to an end much previous research and directing inventors onto a different track.

Finally, there may have been a lack of communication between inventors so that new ideas had to be developed over and over again instead of being incorporated as a matter of course into the next experimenter's model. The result was a fragmentation of effort which was not resolved until somebody had developed a motor cycle which was effective and convincing enough to encourage others to construct imitative models. This did not happen until after the first commercial production.

One result of the lack of continuity of development

was the failure to exploit Daimler's engine in a motor cycle until ten years after it had been developed. The first machine in which an engine of this type was used apart from Daimler's Einspur, was the de Dion-Bouton motor tricycle of 1895, the first commercially successful motor cycle. Such a machine might have been produced several years earlier.

Conclusions

For obvious reasons the development of the bicycle had to precede the development of the motor cycle, but there was very little delay between the first commercially produced bicycles and the first experimental motor cycles. Yet, if we ignore Roper's steam-powered machines, it took at least twenty-five years from the development of the first motor cycle to the first commercial production.

There were two main reasons for this delay. The major one was that the first engine adequate to the task, that of Daimler and Maybach, was not developed until 1884 and then it was set aside for another ten years before anyone attempted to apply it to regular motor-cycle use. The other was that neither the bicycle nor the tricycle was a suitable vehicle for development into a motor cycle until the 1880s. Both cycle and engine had to be developed to an advanced stage before the two could be effectively combined so as to produce not just an experimental machine but a motor cycle with definite prospects of commercial success.

Even so there are indications that with a more sustained effort, a commercially viable motor cycle might have been produced several years earlier. But a sustained effort is not likely to come from individuals, whose resources are usually limited, and it was individuals who had so far performed all the important experiments. Major firms had as yet shown little interest in the motor cycle.

As will be seen in the next chapter, the period of experimentation did not end with the first commercially produced motor cycles, and the important experiments continued to come from individuals rather than major firms.

There follows an appendix on the definition of a motor cycle which is to some extent a preparation for the next chapter in that it explains how motor tricycles and even some kinds of four-wheeled machine, were no less to be considered motor cycles than the two-wheeled machines.

APPENDIX TO CHAPTER 6

DEFINITION OF A MOTOR CYCLE

The first problem in identifying a new industry is defining its product. What kind of product did the new industry manufacture? The motor cycle is conceptually distinct from both the cycle (which includes the bicycle, tricycle, quadricycle, and tandem) and the motor car. It was different from a cycle, especially in the early days, simply in that it was motor-driven, but what made it a motor cycle rather than a motor car? Today we would think of a motor cycle as a two-wheeled vehicle. Thus a modern dictionary definition of a motor cycle describes it as a "two-wheeled motor-driven road vehicle without pedal propulsion".¹ But in the early days just as a cycle could have up to four and sometimes more wheels, so also could a motor cycle. What made it a motor cycle rather than a car was not the number of wheels but the manner of construction.

This issue raised a certain amount of controversy in the pioneering days, and although perhaps not settled to everybody's satisfaction, seems to have been dealt with in a reasonable way in a letter from E.T. Headech to "The Autocar" of 17 April 1897. The writer defines a motor cycle as a "machine of approved tubular construction, with its motor an integral part of that tubework, and the apparatus connected therewith distributed about the machine so as not to mar its outline generally, but certainly not to be boxed up in any way". In comparison an autocar is described as "a machine taking the form of any horse-drawn vehicle, or, in fact, any form of which the seating accommodation is of the carriage type, with cushions, back-rests, and pads, giving the comfort of a spring-frame carriage, the motor being boxed up or hidden away out of sight; wooden or other wheels no matter, for cycle wheels

are often used on horse-drawn carriages".² The essential distinctions made were between cycle-like construction on the one hand, and carriage-type on the other; and between single or tandem-style seating and side-by-side seating, although one form of cycle, the sociable, did have side-by-side seating and at least one motor cycle was built to this pattern, but it was not very practicable.³

A more comprehensive definition of the motor cycle and one which gives a much more complete description of the machine at that time, was supplied later in what was possibly the first instruction book for the motorcyclist ever published: "A motor cycle is a machine constructed, like the everyday bicycle and tricycle, of steel tubing and pneumatic-tyred steel wheels, with a bicycle saddle and steering handle-bar, and pedal-cranks for the rider to propel the machine. It is, in fact, a pedalling bicycle or tricycle, with an auxiliary motor".⁴

But the emerging motor cycle industry was not necessarily to be confined to the production of motor cycles. In a leading article in "The Cyclist" of 19 October 1898, it was emphasized that the cycle maker could best enter the motor industry manufacturing, not just motor cycles, but also "the lighter forms of cycle-built cars, in which tubular frame-work, cycle wheels, and ball bearings are the principle constructional features".⁵

The opportunity then to apply further such skills as he already had, plus the availability of engines purchasable from elsewhere, enabled the cycle manufacturer to enter the motor cycle industry as a manufacturer of motor cycles and light cars, later known as cycle cars. And motor cycles could be in effect any form of motorised cycle, including motor bicycles, motor tandems (fig. 6.4), motor tricycles, motor quadricycles (fig. 6.5), and motor tandem tricycles which sometimes took the form of a tricycle or tricar with one rear and two front wheels in which a passenger was carried in a forecar in advance of the driver (fig. 6.6), and sometimes that of the standard tricycle with an extra seat and pair of pedals added on at

the rear in normal tandem fashion (fig. 6.7).

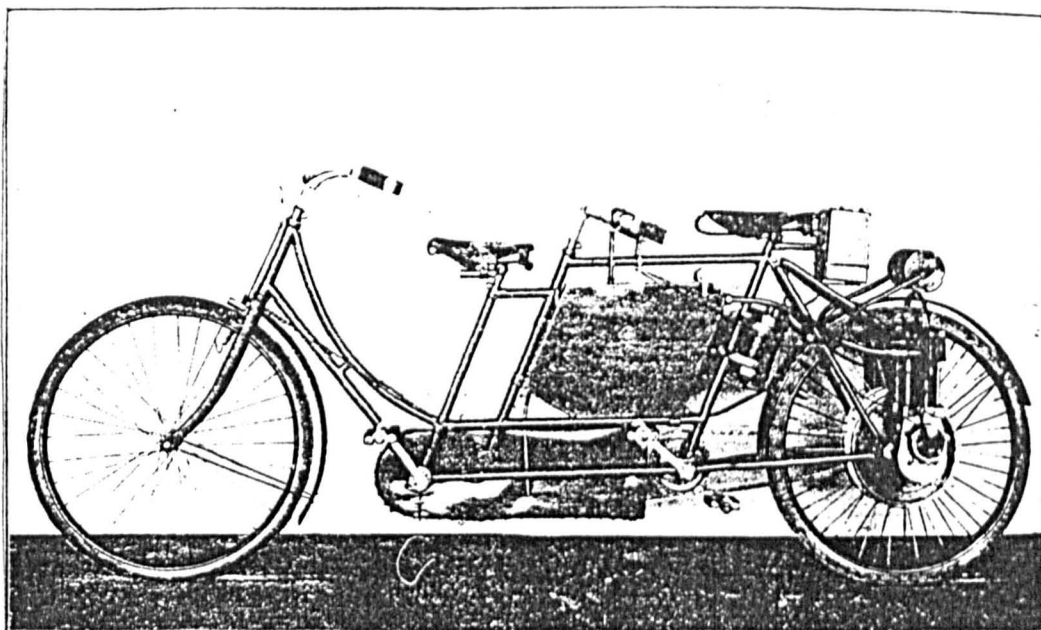


Fig. 6.4. The Humber Motor Tandem
("The Autocar", 4 December 1897)

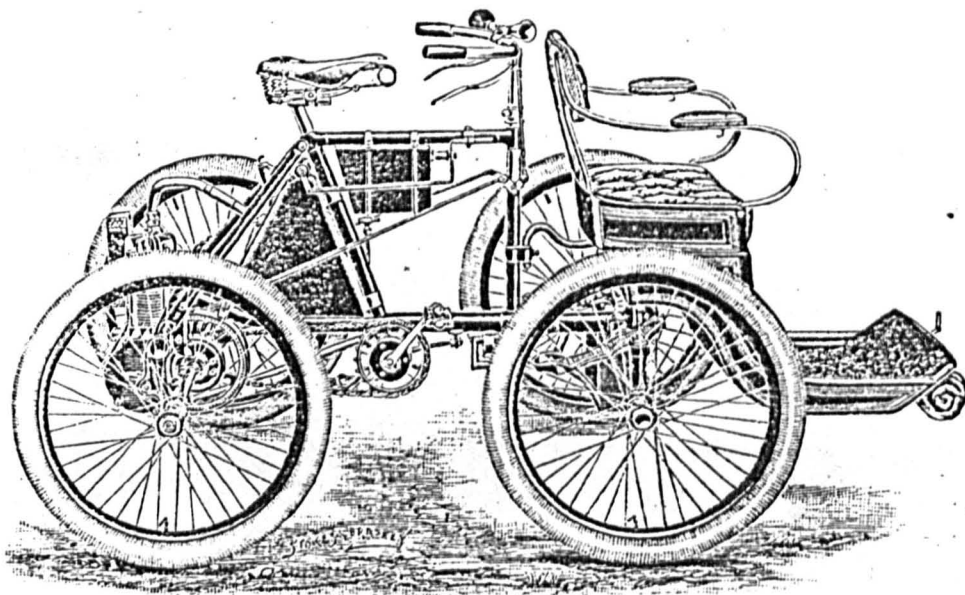


Fig. 6.5. The Beeston Motor Quadricycle
("The Autocar", 14 January 1899)

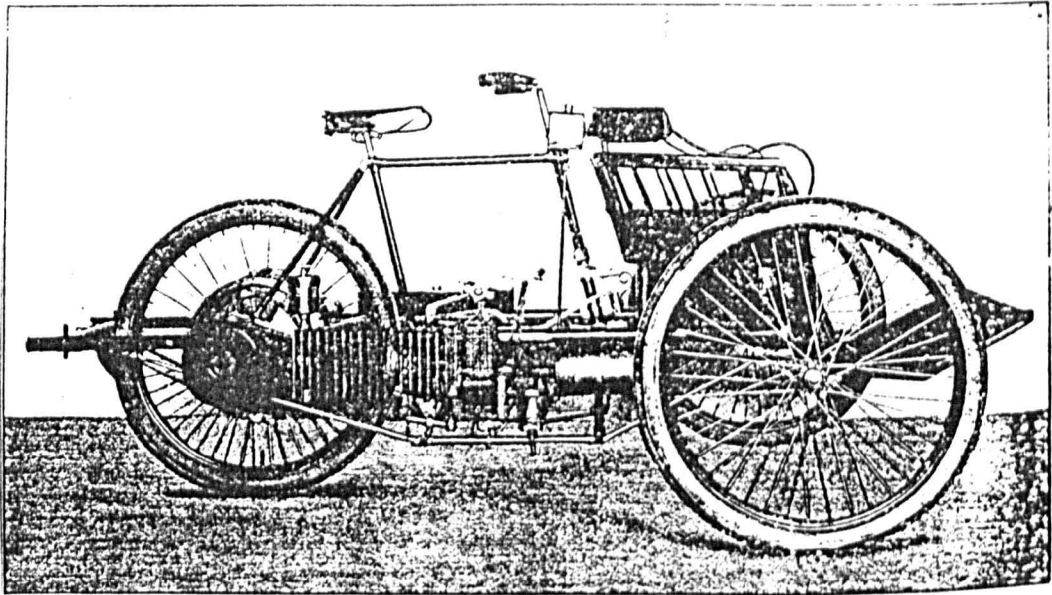


Fig. 6.6. The Humber Motor Tandem Tricycle
("The Autocar". 4 December, 1897)

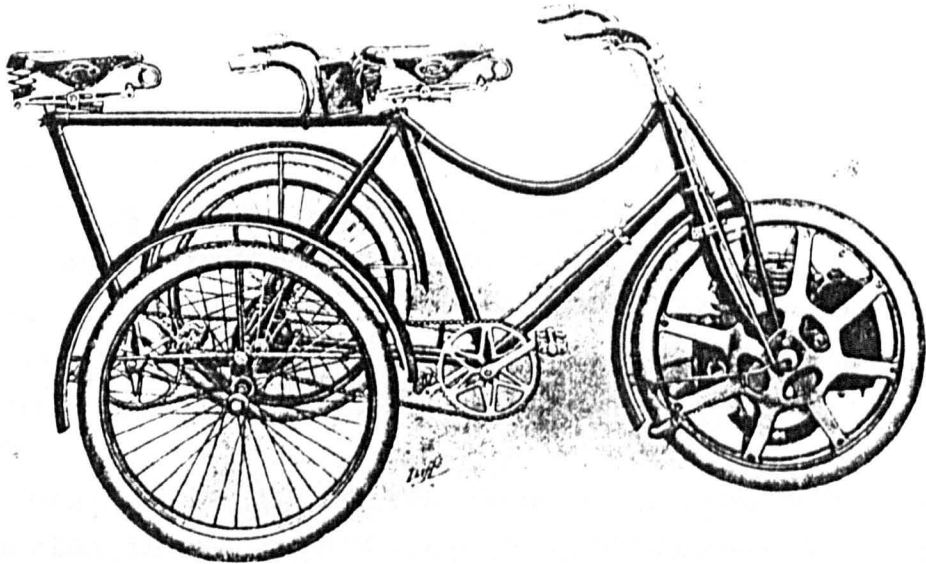


Fig. 6.7. The Singer Motor Tandem Tricycle
("The Autocar", 1 February 1902)

CHAPTER 7

THE EXPERIMENTAL PHASE (2): THE FIRST COMMERCIAL PRODUCTION, 1894-1900

Experimentation did not end with the first commercial production because, as we shall see in this chapter, the first products to be put on the market were simply not good enough to generate sufficient business to sustain an industry. The account of the Hilderbrand and Wolfmüller which follows the introduction, explains how the first commercially produced motor cycle was a disaster both for the producers and the unfortunate souls who bought it.

Some of the machines which followed like the de Dion-Bouton motor tricycle and the Werner motor bicycle, were rather better and did make money for their producers. They achieved little for their British imitators, however, most of whose operations were abortive and lost money despite the grand efforts of H.J. Lawson to create a British motor industry.

Lawson's operations are discussed in some detail. They are followed by an account of the structure of the British motor cycle industry in its earliest years. Later sections deal with motor cycle development from both technical and consumer points of view.

By the end of the period covered there were the first positive indications of a developing British industry in the form of the first successful motor cycles of British design.

Towards the end of the chapter, the second experimental period is put into a theoretical/conceptual perspective with the discussion of some of the propositions presented in Chapter 4.

Introduction

The second experimental period differed from the first much less in a qualitative sense than might be expected. The products of this period were often little better than the experimental models which preceded them. They were still essentially experiments in that they were built in order to be tried out in the hope that something might be learned from their performance. The main difference was that instead of having to try out his inventions himself or through the cooperation of his friends, the inventor was now being paid to allow other people to try out his inventions for him. The results were largely hit and miss.

Consumers in the main, did not take kindly to having to test new and largely untried vehicles which were difficult to control, of poor performance and dangerous propensity. At the outset, however, buyers, lacking experience, and ignorant to the point of naivety, came forward in substantial numbers to try out the new machines. There were soon many complaints and much early disenchantment, particularly with the motor bicycle if rather less so with the tricycle. Thus this premature effort may well have set back the cause of the powered two-wheeler several years. But from the many small disasters of this period, there began slowly to emerge by the end of it the first signs that motor bicycles could work and might even be capable of giving to the consumer a small degree of satisfaction from riding them.

The First Attempt

The first motor cycle to be produced on a commercial scale was the Hilderbrand and Wolfmüller (H & W). It was the result of the joint efforts of the Hilderbrand brothers, Heinrich and Wilhelm, Alois Wolfmüller and Hans Geisenhof. The Hilderbrands had been building experimental motor cycles for several years and in 1889 constructed a steam cycle. In 1892 they joined up with up with Wolfmüller and Geisenhof, and in the same year Geisenhof built a small two-stroke engine. It proved to be rather

underpowered and unreliable, however, so together with Wolfmüller he set out to build something more powerful. The result was an engine of twin-cylinder, four-stroke design, which was too heavy for a standard safety bicycle frame and so a special frame had to be built for it. The machine that emerged from these efforts seemed to perform well, was patented in 1894 and put into production in the same year.¹ Later it was produced in Paris by Duncan & Suberbie (fig. 7.1).

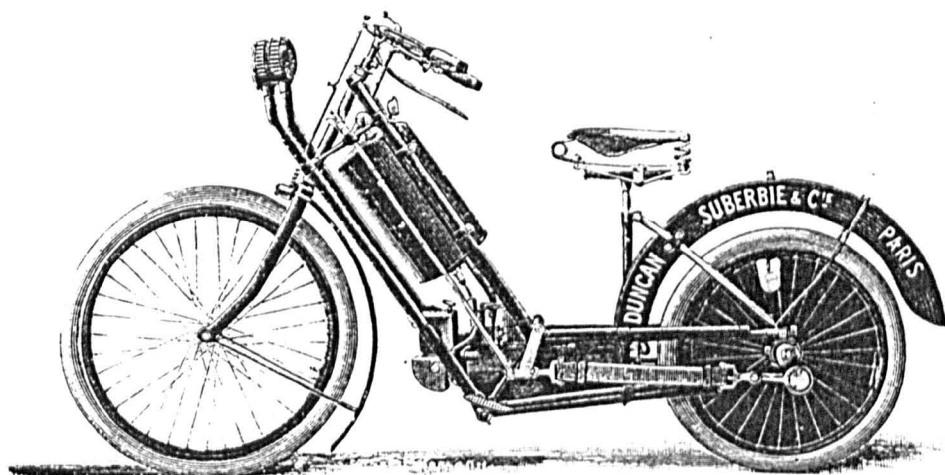


Fig. 7.1. Duncan & Suberbie's version of the Hilderbrand
& Wolfmüller Motor Cycle
("The Autocar", 11 January 1896)

The H & W was the first machine to be called a motor cycle ("motorrad" in German). Like many experimental machines it was a mixture of features of varying degrees of practicality with the emphasis in this case on the less practical. The engine was very large, 1489cc capacity, which gave enough power for a speed of up to 28mph, but there were no flywheels with the result that road performance was very uneven. The absence of flywheels also meant that there was insufficient power to enable the pistons to complete the return stroke so they had to be helped on their way by means of rubber straps. The engine was water-cooled, ignition by hot tube and transmission by connecting rods from the pistons direct to overhung cranks on the rear

wheel. The primitive spoon brake was assisted in the early models by a sprag intended to scrape along the road.²

The H & W was premature and its early production was in every way a mistake. It proved very difficult to start and equally difficult to control once in motion. In the absence of gearing the minimum speed at which it could be ridden was 15-20mph since at lower speeds the engine would stop.³ The machine sold well but soon there were many complaints and demands for repairs. There were also financial problems for the company as it became apparent that the machines were being sold at less than cost.⁴

But before an unaware and inexperienced public had discovered the vices of the H & W, its production had grown into a considerable enterprise. At one time the firm, set up in Munich with the inventors' own capital, was employing 830 personnel on the shop floor and fifty office staff.⁵ Output was ten machines a day and estimates of total production have been as high as two thousand during the three years (1894-7) before the firm went into liquidation.⁶

While pioneering motorcyclists were undergoing their first traumatic experiences with the H & W, motorists were doing somewhat better and there was increasing awareness even in Britain that motor manufacture was the industry of the future. This resulted in the repeal of the Locomotive Acts by a new Act which came into operation on 14 November 1896 making motoring on British roads possible for the first time. But what followed was hardly calculated to impress the world at large with Britain's mechanical skill. At that stage the British knew even less about producing motor cycles than the Germans had in 1894.

The New Industry: Entry

There were four main kinds of entrant to the motor cycle industry in the early years: inventors and inventor-inspired firms, financiers, developers, and imitators.

The inventors were firms like Motorfahrrad-Fabrik Hildebrand & Wolfmüller which were set up to exploit the inventors' own products. The most important firms to enter

the industry up to 1900 were in this category. These included de Dion-Bouton, the first firm to produce a successful motor cycle, albeit a tricycle, and the Werner Brothers, the first to produce a commercially successful motor bicycle.

Inventor-inspired firms were those which entered the industry by producing a machine which the inventor was unable or unwilling to produce independently. In some cases the inventor sold his patent outright to the prospective manufacturer, in others, the manufacturer paid a royalty. The Singer (patented by Perks and Birch) and the Holden (produced by Motor Traction Co.) belong in this category.

The financiers were firms promoted by people with large amounts of capital to invest and who saw the new motor industry as an outstanding speculation. H.J. Lawson was the chief initiator of this kind of activity and he promoted a number of firms including Great Horseless Carriage Co., Daimler, Beeston Pneumatic Tyre Co., and New Beeston Cycle Co.

The developers were firms which picked out an interesting design and set out to develop something significantly better. They were extremely rare at this stage of the industry's growth because so little was known in Britain about motor cycle technology, and probably the only firm of any significance of this type was Cycle Components Manufacturing, the producers of the Ariel.

The imitators were firms which simply imitated the products of other firms, sometimes under licence and sometimes illegally. They were certainly the largest group of firms in the industry numerically during this period, while at the same time being the weakest in terms of commercial performance since the products they imitated were rarely of sufficient quality and performance to justify imitation. With one or two exceptions, little is remembered of these firms and they will not be discussed in any detail in this chapter.

Since the inventors and developers are discussed in

the technical and consumer sections of this chapter, they will not be discussed here. This leaves only the financiers which merit further discussion at this stage, and particularly the activities of H.J. Lawson.

H.J. Lawson: How Not to Start an Industry ⁷

Before becoming interested in motor vehicles, Lawson had been involved with the cycle industry for many years. He had some technical training, and a claim to a number of inventions. Probably the most important of these was the safety bicycle of 1879 although his machine did not work too well and was a commercial failure. In 1880 he took out a patent for "the first British motor car" but nothing came of it.⁸ Later he turned his attention away from invention to business and he shared in the promotion of a number of cycle companies. He was a director of the Dunlop Pneumatic Tyre Company when it was reconstructed in 1893, and in the process the company's capital was increased from £75,000 to £3,000,000 making Lawson and the other directors very rich. Thus he was provided with sufficient funds to initiate his plans which were none other than to "corner" the British side of the motor industry by buying up all patents relating to motor vehicles.⁹

Among the patents Lawson acquired on behalf of the various companies he set up were those for the Daimler car, the de Dion-Bouton tricycle, and the Pennington motor cycle. The purchase of the last of these patents, for £100,000, has been described as "the greatest mistake ever known in the motor industry"¹⁰ since the machine proved impracticable and was never put into production.

Yet to some extent at least there probably was justification in buying patent rights since, while British firms had been effectively prevented by the Locomotive Acts from developing motor vehicles, there had been no such limitation overseas. A few overseas firms had been producing motor vehicles for several years and their products were reasonably good for the time.

It was not possible, however, to set up a motor indus-

try simply by importing overseas patents. It required also a certain amount of knowledge and ability in motor manufacture and this was lacking. At that time there were few motor engineers in Britain and most of those that were available had obtained their experience in steam locomotive works.¹¹ They did know something about stationary gas engines which had been in use since Lenoir's time, but they had little experience of petrol engines.¹² In these circumstances, where would Lawson find works managers, engineers, designers and skilled personnel, and who would be capable of acting as directors of his companies? Lawson alone perhaps had the necessary management experience and he has been described as being in the position of a "one-man company".¹³ His remedy was to appoint to the boards of his companies what have been described as "dummy directors" who could never agree with each other so that management was able to govern them.¹⁴

The management, however, was in general no better than the directors. British engineers, according to Duncan, were, despite their lack of experience and know-how, unwilling simply to copy the continental models, for which the patent rights had been acquired at such expense, but insisted on improving them. This meant that instead of using their vast capital to get rapidly into production and actually begin to achieve some return, the companies were bogged down for months and sometimes years in costly experiments involving expenditures of thousands of pounds.¹⁵ These experiments, which were largely unsuccessful, were said to have cost the Beeston Motor Company up to £10,000 in two years, and the Great Horseless Carriage Company at least £15,000.¹⁶

There is little to be gained from taking this account very much further. Despite periodic reconstructions, almost all of Lawson's firms eventually failed and most of them achieved little or no profit. The only long-term survivor was the Daimler Motor Company.

There is much we can learn, however, from these accounts of the H & W and the Lawson enterprises. It is

often thought that one of the prime requisites for the establishment of a new industry is an abundant supply of capital. But as we have seen, when producers set out for the first time to manufacture an entirely new product which is still experimental, and largely untried in the real world of wear and tear at the hands of consumers, then a good supply of capital, far from being an advantage, may in fact be a disadvantage. Capital is clearly a necessity, but when it arrives too soon in the day it can easily encourage manufacturers to rush their products onto the market before they have been brought up to a satisfactory level of performance, a level which will encourage rather than deter the consumer. Later in the chapter, we shall see how almost all the important motor cycles developed and put into production during this period were the work of people of relatively modest means.

Lawson failed for various reasons, some of which were of his own making. But many of the problems he experienced confronted all firms which set out at that time to produce motor vehicles with the result that few made a profit before the turn of the century.

The Size and Structure of the Industry

There are very few statistics of any kind relating to the early motor cycle industry. An analysis of marques listed in Erwin Tragatsch's "The Illustrated Encyclopedia of Motorcycles" (1978), certainly the most authoritative work of its kind so far published, indicates a total of 24 firms which manufactured motor cycles in the United Kingdom up to 1900.¹⁷ But since Tragatsch is mostly concerned with two-wheelers, we must adjust this number to allow for firms which produced tricycles only.

According to Walford who was involved in the early motor cycle industry, there were probably about fifty firms manufacturing motor tricycles by 1900.¹⁸ If we add these to Tragatsch's 24 and subtract a number to allow for those of the 24 which also produced tricycles, we arrive at a total of something like sixty firms which produced motor

cycles up to 1900. Few of these produced motor cycles before 1898.

There are no production figures for this period, but the numbers of machines displayed at the Stanley Show, the most important of the cycle shows, presented in Table 7.1, give some indication of the development of the industry and the growing interest in manufacturing motor cycles. These figures include some foreign machines, but the vast majority were British made although mainly copies of foreign machines and powered by foreign engines.

	1897	1898	1899	1900	1901
Motor bicycles	8	6	1	1	110
Motor tricycles	8	16	67	19	4
Motor quadricycles				10	8

Table 7.1. Numbers of Motor Cycles Displayed at Stanley Shows, 1897-1901¹⁹

The table illustrates the industry's slow start in 1897, followed by the rapid development of interest in motor tricycles in 1898-9. For a time the two-wheeler was abandoned in favour of the safer tricycle, but by 1900, successful motor bicycles were being developed and had already begun to replace the tricycles. The development of the quadricycles represented a demand for passenger carrying capacity, but the design was to prove short-lived, soon giving way to the tricar.

The industry even by 1900 was still more of a future hope than a present reality. No firm dominated the market which was very small. A few may have made motor cycle production pay, but the majority almost certainly did not.²⁰ One of the more successful manufacturers, Eadie, advertised that "More motor cycles of Eadie manufacture have probably been sold than any other make".²¹ Unfortunately no figures were given and it is unlikely that Eadie could have approached de Dion's output even remotely,²² but

it is possible that they sold more machines in the United Kingdom than any other manufacturer at that time. It is doubtful, however, that their production could have been very great since they soon abandoned the manufacture of complete machines in order to concentrate on cycle parts.

Another firm which is said to have done well at that time was Cycle Components, producer of the Ariel. The Ariel was a substantial improvement on the de Dion and the first important British design. According to Walford, it was sold in large numbers after 1899-1900,²³ but years later it was reported that its manufacture had been "unremunerative".²⁴ Thus even the apparently successful firms failed to make money, but then we should note that the "large numbers" referred to above, were probably no more than a few hundred machines a year.

One of the few machines of that time for which we do have a more definite production figure is "The Compact". This was the work of Edwin Perks, was patented in 1899, and manufactured by him in partnership with J.N. Birch. Two hundred units of this machine had been sold by October 1900.²⁵ The patent was then sold to Singer in whose hands it was apparently even more successful. Manufactured as the Singer, it was later described as the first British built motor bicycle to be put on the market in any numbers.²⁶

It is apparent then that the annual output of even the most successful firms was to be measured in hundreds rather than thousands, and the total output of the industry by 1900 could not have been more than a few thousand.²⁷ Furthermore, the successful firms—if, indeed, there were any that achieved real commercial success—were the exceptions. The vast majority of would-be motor cycle manufacturers were not successful at all. An example of the latter was a small firm which attempted to produce a machine it called the Buchet, the name of its bought-in engine: "The Buchet is an example of types which were certainly rushed on to the market by energetic cycle retailers possessing no sizeable market and little capital. It

consisted of a small French engine mounted inside the diamond frame of a good cycle built in a small cycle shop. As far as I know, only two were ever built. As they produced no profit, the agent wisely withdrew from the new business".²⁸

The practice of dealers building a few machines of their own from bought-in parts, usually to special order, was common in the cycle trade. But it was less successful with motor cycle manufacture which required an understanding of the new technologies of engine and ignition systems. As we have already seen, such ability was generally lacking even among firms which made a major effort to enter the industry. What then could the British industry do beyond the slavish copying of continental designs? Not a great deal until it had learnt a bit more about motor cycle technology. As we shall see in the next section, most British firms entered the industry with imitations of foreign models. But by the end of the period, one or two very interesting and highly innovative British designs had been developed.

The Motor Cycle as Technical Product

The aim here is to concentrate on motor cycle design: to look at design in specific terms, and to consider production processes from the point of view of how they may have influenced the emergence of one design or another. The emphasis then is on the motor cycle as a machine, its technical specifications, and its performance. Some attention will also be given, however, to the designers and how they first entered the industry and managed to get their machines into production. Consumer aspects are discussed in a following section.

In the earliest days of the industry, few people were willing to take the motor bicycle seriously: "We have no hesitation in saying that the motor cycle of the future will be the three-wheeler, at least, and possibly a quadricycle".²⁹ These words were remarkably unprophetic, but they did represent the feeling at the time. The

tricycles, large, heavy and slow, did at least have three wheels on the ground—most of the time. The two-wheelers, lighter and faster, were a good deal less stable and usually dangerous in all but the most favourable conditions. Yet from the point of view of developing commercially effective machines, the motor bicycle was not really vary far behind the tricycle. The first two-wheeler in this category, the Werner, was in production by 1897, only a year or two after the first tricycle, the de Dion-Bouton. These two machines overshadowed all others in the period.

de Dion-Bouton and the Tricycles

Count Albert de Dion and Georges Bouton first met in 1882. They established a partnership and in 1887 they constructed a steam tricycle. Seven years later in 1894 they won the Paris-Rouen race with a steam-powered machine, but noticing that all of the other vehicles in the race were driven by internal combustion engines, they decided to develop one themselves.³⁰

Basing their design on the original Daimler engine, it took them only until the following year to build a prototype. It was a vertical, single-cylinder, air-cooled four-stroke of 138cc capacity. It weighed 40lb and produced $\frac{1}{2}$ hp at 1,500rpm. The engine was similar to Daimler's, but there was one major difference, the ignition system. Initially they had used a hot tube as in Daimler's engine, but it was soon replaced by a coil, battery and contact breaker, which synchronized the spark with the stroke so as to fire at the best time.³¹ This was an innovation of great importance.

de Dion-Bouton constructed their first motor tricycle in 1895 by installing the engine in a standard pedal tricycle. It was positioned immediately behind the rear axle (fig. 7.2), the fuel tank and carburettor were placed under the saddle, and the battery attached to the top frame tube. The complete machine weighed 200lb which was rather heavy for such a low powered engine. Tests were encouraging, however, and larger engines were installed the following

year giving a level of performance which was good enough to win for the de Dion both the Paris-Marseilles-Paris race and the Paris-Mantes race of 1896, beating both the H & W and the Bollee.³²

The de Dion engine marked the effective beginning of the motor cycle industry, and much more so than the H & W. Not only did it power de Dion tricycles, but it was offered in various sizes to any manufacturers wishing to build their own machines. As there were no comparable engines available at the time, de Dion engines dominated the motor cycle industry for several years and continued to do so despite the rash of imitations that soon began to appear.

The de Dion tricycle became the prototype for most of the early British made tricycles. Lawson had acquired the British patent rights for de Dion inventions, and after obtaining a specimen of the de Dion machine, he had it copied by Accles of Birmingham whose designer, Paul Renouf, modified it by putting the engine in front of the axle.³³ This was a desirable improvement in the design since

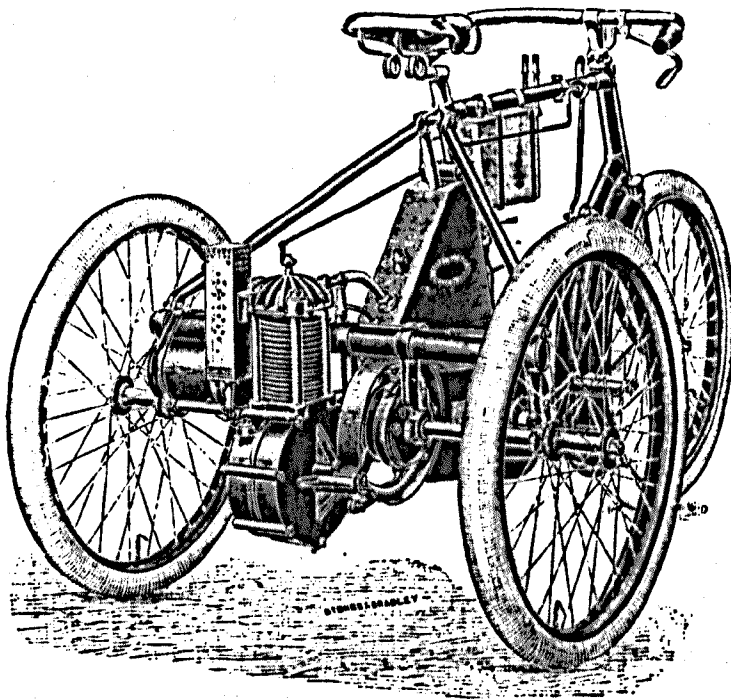


Fig. 7.2. Beeston version of the de Dion-Bouton
Motor Tricycle
("The Autocar". 4 December 1897)

otherwise the machine was likely to be unstable, but when Lawson's firm, Beeston (later New Beeston) commenced production, it adopted the original layout, producing a machine almost identical to the de Dion (fig. 7.2). The vast majority of British motor cycle manufacturers followed suit, some building it under licence, others copying it without regard to the patent. Thus the de Dion's worst fault was preserved.

We can only speculate on why such a design was preserved and copied, and why it was adopted in the first place. Probably it was much easier to place the engine behind the axle than in front. Such a position would have simplified assembly and given better access to the engine. Thus a correspondent of "The English Mechanic" criticized the Ariel tricycle which had a different layout: "The first thing that strikes you is the position of the engine, which is placed in front of the back axle, the makers claiming a better distribution of weight resulting. This was tried by French makers some years ago and given up, the reason being not far to seek. In order to place engine in front everything has to be cut down as narrow as possible, several bad features introduced thereby, that more than counterbalances any supposed advantage".³⁴ The writer, who signed himself "Monty", went on to support his argument in more technical terms, and his comments were reproduced elsewhere with apparent approval.³⁵

The issue was hotly disputed by Charles Sangster, a director of Cycle Components Manufacturing, manufacturers of the Ariel. According to Sangster, who was to be proved right, most of Monty's comments were fallacious, and even the suggestion that the French had previously tried such a design was incorrect.³⁶ It also emerged that Monty has once worked for Sangster and been sacked,³⁷ so he may have been motivated by personal grievance. However, he did get support from elsewhere, which would appear to indicate not just a general lack of technical competence among people involved with the industry, but also, even at this early stage, a remarkable degree of design conservatism. As will

be seen later, whatever technical justification Monty may have had for his comments, within a year or two there was nothing but praise for the Ariel, and the de Dion type was itself a subject for criticism.

Meanwhile, manufacturers lacking experience of motor tricycles were naturally inclined to copy the original de Dion product which was known and successful, rather than the Renouf design which, until Ariel developed it and proved it, was little known and not yet in production. There is a considerable commercial advantage in being first, and an original product that has become established often looks a safer bet than a new one however good the latter may be. According to another writer in "The English Mechanic", also, coincidentally, replying to a point made by Monty, "the reason English motor-cycle makers follow the design of the De Dion motor so closely is that they do not want to go to the expense of experimenting with new types, preferring to build a machine which will work and be a source of income".³⁸

The early motorcycling scene in this country, then, was dominated by motor tricycles most of which were to a large extent close copies of the original de Dion machine. The Ariel (fig. 7.3), dating from 1898, was the first machine to represent a significant improvement on the

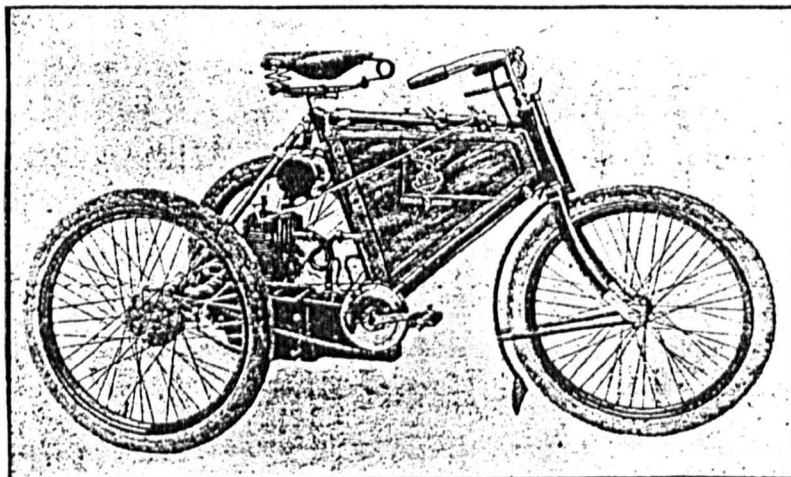


Fig. 7.3. The Ariel Motor Tricycle
("The Autocar", 25 March 1899)

de Dion. Designed with a longer wheelbase to allow the extra room required for the engine to be placed more centrally, it was rather heavy. Nevertheless, it was vastly superior to the de Dion, and it was soon earning high praise in the trade press: "the Ariel motor cycle is second to none in the world",³⁹ and, from a letter writer, "I have examined and used the Ariel motor considerably, and every detail as well as the ensemble will compare with advantage to the French de Dion. Certain it is that the Ariel complete tricycle is far before any tricycle with the motor overhanging the back axle....."⁴⁰ Yet most manufacturers still remained faithful to the original design and some of them may have achieved good commercial results with it.

The de Dion type motor tricycle was not the only doubtful machine—doubtful despite its commercial success—to be inflicted on an unsuspecting public in the late 1890s. There were tandem tricycles, quadricycles, and even sociables, about which one writer concluded: "we do not think two people would derive much pleasure from a ride on it".⁴¹ But worst of all were the motor bicycles where the problems of producing a practicable machine were far greater than for the tricycle

Motor Bicycles: Some Brave Attempts

The development of the motor bicycle proceeded in several different directions all at approximately the same time, and almost all of which proved to be unsuccessful in one way or another. The first entirely British designed motor bicycle that went into production was the work of Major (later Colonel) Henry Capel Lofft Holden of the Royal Engineers. The machine was in some respects the last of the line of development which began with Butler's invention of the 1880s. Like the latter and the H & W, the Holden (fig. 7.4) was driven locomotive style by rods direct from the cylinders to overhung cranks on the driving-wheel axle. Even so it was a substantial improvement on the H & W. Its large, slow-running engine, consisting of four horizontally

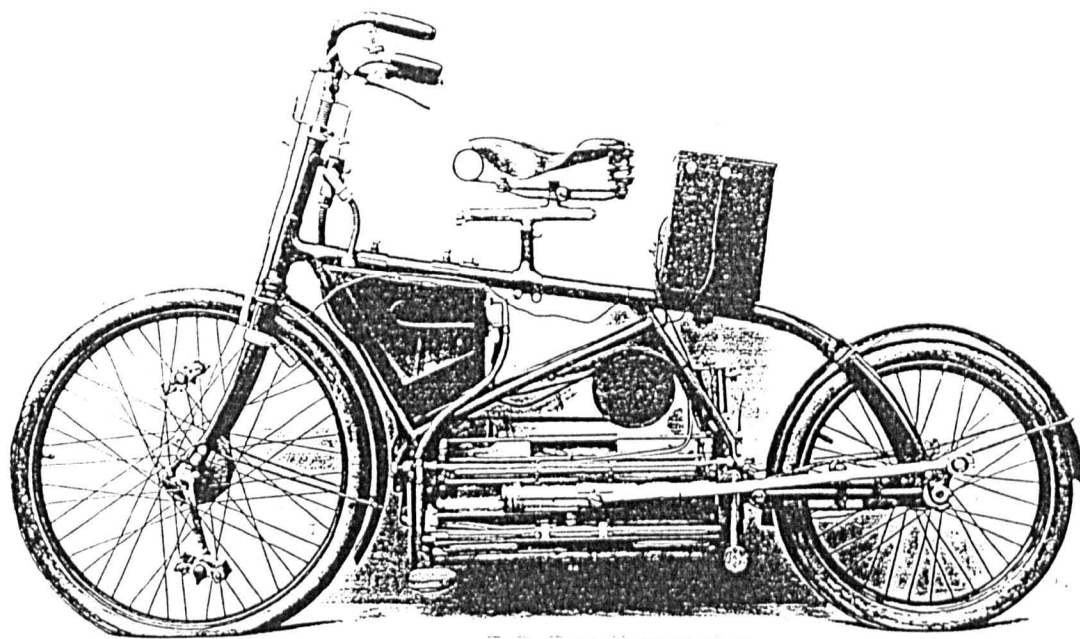


Fig. 7.4. The Holden Motor Bicycle (sectioned)

opposed cylinders, gave it a degree of flexibility far superior to the typical single-cylinder motor cycle of the time in that it helped to compensate for the lack of variable gears. Ignition was electric and the automatic lubrication system was very advanced for the period. The machine was capable of 25mph and its later models were said to be capable of covering two hundred miles without stop for petrol or oil.⁴²

Holden's motor bicycle was relatively simple in construction from a workshop point of view,⁴³ yet, priced at about £80, it was expensive probably because, unlike most machines of its time, it was built almost from first principles. There were none of those cost advantages which accrued to manufacturers who simply took a standard bicycle or tricycle frame and hung an engine on it. Such machines could be put together—"developed" might be too flattering a term—if not quite overnight, then certainly within a relatively short time, while the Holden was under development for about four years before it went into production. Thus by the time it was manufactured by Lawson's Motor

Traction Company of Coventry, it was probably too late. As a design it was already nearing obsolescence, and it was much too expensive compared with the cheaper, simpler machines now coming onto the market. Production ceased in 1902.

The Holden was an unusual and highly original machine. This degree of originality became less necessary with the development of the de Dion engine which could at least in theory be installed in a modified bicycle frame. Unfortunately, the earlier engines were rather too heavy and clumsy for easy installation in a bicycle frame, and the first results of such efforts were not at all promising. The de Dion motor bicycle was little short of a disaster.

The British version of this machine was produced by Beeston under Lawson's British patent. It is illustrated in fig. 7.5 and, as can be seen, it was ugly in appearance, the engine was altogether out of proportion to the relatively light frame, and it was placed too far back for good weight distribution. It was said to be capable of 27mph,⁴⁴ but it was jerky at low speeds and liable to skid, so much so that the manufacturers recommended it for use only on dry roads. It was no kind of success and ultimately it was reported that "Recognising the uselessness of the motor bicycle for general use, the company do not propose to

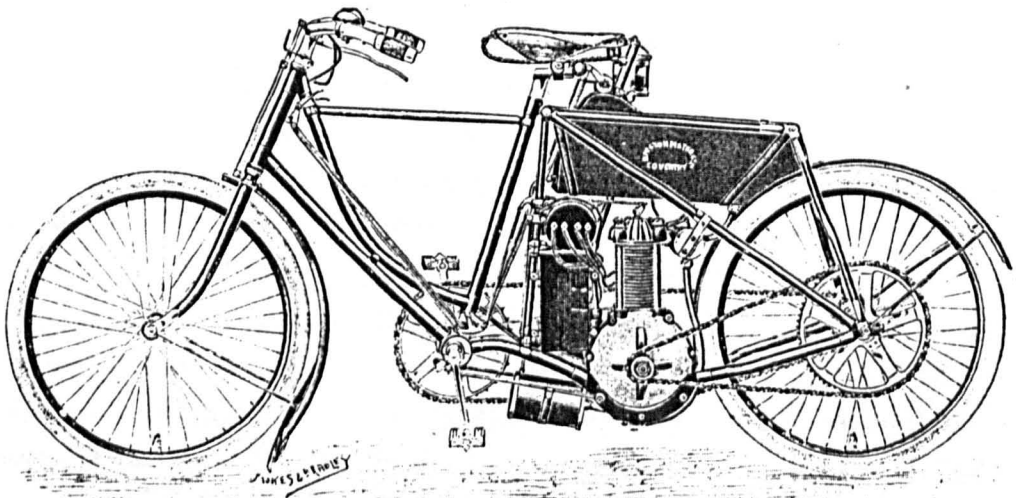


Fig. 7.5. The Beeston version of the de Dion Motor Bicycle
("The Autocar". 4 December 1897)

continue their manufacture in large quantities".⁴⁵

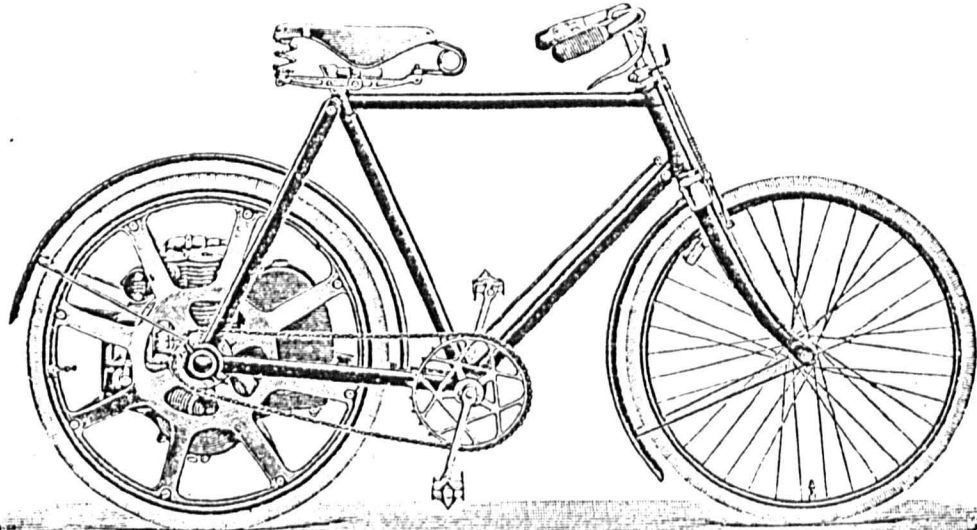
The best that can be said for machines of this calibre is that they did at least go into production if only for a brief period. The Pennington, an original design and Lawson's most expensive acquisition, did not even achieve that distinction since it lacked some of the most basic requirements of a motor vehicle. The engine projected behind the rear wheel supported by frame extensions, possibly the worst engine position ever thought of. It had neither carburettor nor a means of cooling, and yet somehow it worked. The machine was capable of 30mph, but it rarely covered ten miles without breaking down.⁴⁶

A better design and one that did achieve a modest commercial success although it did not survive more than three or four years, was the work of Edwin Perks. Perks had worked for the Beeston Motor Company but was sacked for doing his own work in their time. In 1899 he constructed his motor wheel, an engine built into a wheel that could be installed in any normal bicycle or tricycle frame. The idea was not original since Millet had done much the same kind of thing though with a vastly different engine in 1894, but Perks' design turned out to be rather more effective. It performed well and a motor bicycle incorporating the motor wheel was manufactured in partnership with J.N. Birch under the name "Compact".⁴⁷

This achieved good sales and became even more popular after the design was sold to Singer who developed various other models along similar lines. The Compact had been aptly named as its neatness of appearance (fig. 7.6) and simplicity of control were outstanding. Its most important innovative feature, however, was the addition of a Simms-Bosch low-tension magneto—probably the first time such equipment had been installed in a motor cycle.⁴⁸ Until then motor cyclists had had to rely entirely on their batteries which needed frequent recharging. But the machine was not without its faults. Its transmission was rather harsh and it had the tendency to sideslip of most of the motor bicycles of the period.

SINGER MOTORS.

(PERKS & BIRCH'S PATENT.)



On view and in use at NATIONAL SHOW, CRYSTAL PALACE, Nov. 23rd to Dec. 1st.

LISTS AND PRICES FREE.

SINGER CYCLE CO., LTD., COVENTRY.

LONDON—17, HOLBORN VIADUCT, E.C.

Fig. 7.6. Advertisement for the Singer Motor Bicycle,
formerly the "Compact"
("The Autocar". 24 November 1900)

The Singer was one of the more successful experimental machines, but it failed to solve the main technical problem of this time: where to put the engine. The ideal position was low down in the frame between the wheels. This was not possible, however, with the standard bicycle frame because the pedalling gear was already situated there. Many other positions were tried with varying results. The Singer, with its engine installed in the rear wheel, worked well despite having its centre of gravity too far back. In comparison, the Werner had its engine in an even more unlikely position, and from a technical point of view should have been a commercial failure.

The Werner: A Commercial Success

Michel and Eugene Werner were Russians, former journalists, who settled in Paris where they established a small business, selling and sometimes experimenting on typewriters, cinematographs, phonographs, and other recent inventions. There are conflicting accounts of how the Werner motor bicycle itself was invented and who invented it. It may have been the work of Michel Werner himself, it may have been constructed by Werner but copied by him from a design originated by Johathan Young who had business connections with the Werners, or it may have been invented by Hypaulite Labitte who brought the machine to the Werners' workshop in response to an advertisement for motor inventions.⁴⁹

Whatever its origin, it seems certain that Michel Werner was not in any way an engineer and that would help to explain how such a fundamentally unsound design was taken seriously. Nevertheless, taken seriously it was and it was put into production with immediate success. Output was only a dozen in 1897 but had increased to three hundred in 1898 and over a thousand in 1900.⁵⁰

The Werner was the first commercially successful motor bicycle. It was manufactured in England by Lawson's Motor Manufacturing Company and copied with minor variations by several firms, but there is little evidence that the imitators achieved much success with the design.

Technically the Werner was an innovation not for its engine which was of de Dion type,⁵¹ nor for its frame which was a fairly standard bicycle frame, but for the way they were put together, with the engine placed in a vertical position over the front wheel and directly in front of the steering head (fig. 7.7). Whether or not the design was original the Werner was probably the first viable motor bicycle with this layout. And with the engine so close to the front wheel, it was extremely simple to connect the two by a belt. At that time the use of a belt in place of other methods of transmission was a considerable improvement.

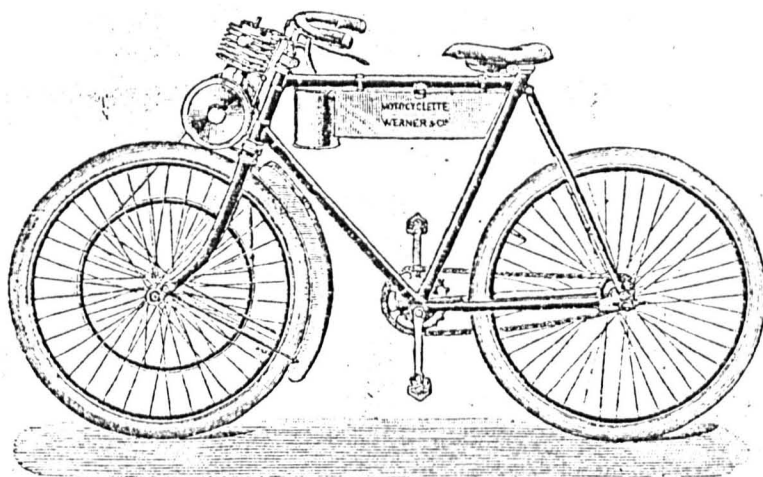


Fig. 7.7. The Werner Motor Bicycle
("The Autocar", 30 April 1898)

Machines such as the de Dion motor tricycle and the Compact (Singer) were built with the transmission direct from engine to wheel via gearing which was rather harsh in operation. Early chain driven models were not much better. The belt, on the other hand, was flexible enough to cushion such harshness producing a much pleasanter machine to ride. Following the Werner's lead the belt was widely adopted and remained the predominant form of transmission until the first world war.

The engine placing was ingenious because of its simplicity, and, together with the belt, produced a smooth running machine with good performance. It had the familiar appearance of the standard diamond-frame bicycle, for in fact it was little more than a bicycle with engine attached. It was free of the electrical equipment which few people understood, as the ignition in the first year or two was hot tube which could be set in operation by putting a match to the wick of a spirit lamp. Once lit up, it was started by pedalling off in exactly the same way as with an ordinary bicycle.

But the Werner was both uncomfortable and hazardous to ride. The engine placing made the steering heavy and the machine as a whole top heavy. As a result skids were

common and potentially lethal with the flame of the lamp setting fire to petrol running from the carburettor. The necessary improvements did eventually follow, however, with the hot tube giving way to electric ignition, and in 1901 the engine being placed where it ought to be (for which see next chapter).

Summary and Conclusions

The most remarkable thing about the Werner was that it was so successful commercially when it was so bad from an engineering point of view. However, it did have the most important attribute of any machine at that time: it worked and it worked well. Good engineering results in better products, but better for whom? The Holden, one of the better engineered motor cycles of its day, failed commercially at least partly because it was too expensive. The de Dion tricycle, like the Werner, was poorly designed, but was a commercial success. In both of these cases poor design was compensated by short development periods and simplicity of construction which kept prices low. There was something to be said then for these early products, but not too much. They made money for the firms which developed them, but they were so lacking in comfort and safety that they could hardly begin to attract the kind of rider whose custom was required in order to form a substantial market. Thus the market would remain small and would not expand until better products became available.

The more successful motor cycles of this period were designed as simply as possible and put into production as quickly as possible. This was both a strength and a weakness resulting in products that were cheap but crude and uncomfortable to ride. Development was lacking, but would it have been justified to spend very much on developing such basically unsound designs? Almost certainly not. The Ariel tricycle, a result of a major effort to develop a superior machine, was far better than the de Dion, but it made little or no money for its manufacturers. Imitators of the Werner appear to have achieved little from their

efforts to develop an improved model. The conclusion then is that this was still a time for experiment and it would remain so until there emerged machines of sounder basic design and which would justify a more sustained developmental effort. Meanwhile, those brave spirits who wished to indulge in the new sport were more than likely to find that the pains outweighed the pleasures.

The Motor Cycle as Consumer Product

The major problem in discussing the early years of the motor cycle from a consumer point of view, is how to interpret the data. There are two main sources of data: journals and personal memoirs. The journals, whether aimed at the trade or a wider readership, contain the most comprehensive accounts. These vary from technical descriptions of the machines themselves, often if not always by highly skilled and experienced engineers, to brief, informal road tests (though nothing like those we get today either in terms of detail or systematic evaluation). There are also letters describing readers' experiences, and long, detailed accounts of particular journeys. Whether letter or technical article, most of these writings, especially in the earlier years, are by people who had some connection with the trade, although this is not always apparent and there were certainly some amateur riders.⁵⁴ We should treat with caution therefore the optimism of many of the early accounts of motorcycling, since the writers were often involved in selling the machines they were praising.

It is possible to some extent to counter any overoptimism of this nature in purely technical terms. Most of the early machines were bad designs and, given the poor roads of the day, any rider who did not occasionally fall off must have been extraordinarily lucky.

Personal memoirs are another matter. They are usually written long after the events they describe. The writer may look back with nostalgia at days long gone and regret their passing. It may be, therefore, that his account will be no less optimistic than contemporary material. Not so

the writings of the Rev. Basil H. Davies, henceforth referred to as BHD, whose personal memoirs are the most important of those which concern us in this chapter.

BHD was a true pioneer and one of the first amateur riders in the country. He began motorcycling in 1897 and had experience of riding all the important types of the period. His articles appeared in the motorcycling press from 1903 onwards, and in 1904 he was given a regular page in "The Motor Cycle" under the name "Ixion". From then on he was a regular contributor and in some issues he wrote articles under both his pen name and his real name while preserving the fiction that he was two different people. He continued to write for the magazine until his death in 1961, but although he wrote about motorcycling, rode in competitions, and at one time had a connection with Triumph through his friendship with Mauritz Schulte, he never considered himself a professional motorcyclist. His profession remained the Church until he retired in 1940 because of poor health, but for which, it has been suggested, he would have finished up a bishop.⁵³ His books which include instructional manuals, memoirs, and a history of the motor cycle, taken together with his contemporary writings, are almost certainly the most important single source for the history of the early motor cycle industry.

If in some of the accounts which follow, BHD sometimes makes early motor cycles seem too bad to be true, he was probably not exaggerating.

The Basic Motor Cycle

Early motor cycles were generally primitive in design and simple in construction. The basic motor cycle of the 1890s would have consisted of a cycle-type frame and wheels, an engine (usually air-cooled), and no more additional equipment than was absolutely necessary to make the machine go. The latter included a means of transmission to take the power from the engine to the driving wheel, an ignition system, a petrol tank and carburettor in one piece, an oil tank although lubrication was usually manual,

and control levers and rods. Brakes were usually of cycle type.

Many features were lacking that today would be standard equipment. There was little or no springing except for the seat. In most early models there was no clutch or device to free engine power from the wheels, so that the engine could only run when the machine was in motion. There was often no throttle to regulate speed although machines with electric ignition could be slowed by retarding the spark. Finally, there was rarely any system of variable gears. This meant that many machines, especially those with hot tube ignition, could either operate at maximum speed or not at all except by pedalling with the engine switched off.

To ride such a machine under modern conditions would be a hair-raising prospect, but it could hardly have been less frightening in the 1890s. There was not the volume of traffic in those days that there is today, but roads were unmade, inclined to be stony or pot-holed, and covered by an inch or two of dust in the summer and mud in the winter. What little traffic there was was inclined to be less disciplined than today so that slow-moving farm carts were likely to be encountered travelling on the wrong side of the road and often unlit at night.

But in order to consider the appeal of motorcycling in the 1890s, we have to forget about modern traffic and road conditions and the sophistication of modern machines; we have to disregard our own expectations, and consider instead those of the prospective pioneering motorcyclist. The pioneer was almost invariably an experienced cyclist. He had experienced the road hazards of his day and was not put off by them. He was likely to anticipate the dangers of greasy roads and have some idea at least of how to avoid them. He had no experience, however, of machines of the weight of the new motor cycles, and little understanding of how the unsatisfactory weight distribution of some poor designs might affect their handling. Nor did he have much idea of how they worked or what to do if something went

wrong.

Subject to these qualifications, the beginning motorcyclist may well have had the following expectations of his new machine:

1. It should not be too complicated to understand and control.

2. It should start easily and having been started it should keep going until the rider wants to stop.

3. It should have reasonable performance on level ground, let us say, better than a pedal cycle, otherwise there was no point in the extra expense; and it should go up hills (if possible!).

4. It should handle in traffic, that is, speeds should be variable and brakes should work.

5. It should be reasonably stable, and certainly no less so than unpowered machines.

6. It should not be too uncomfortable to ride.

Few early motor cycles measured up to all of these standards. Some idea of the state of the art and the attitudes of potential consumers in 1897 is provided by a letter from a "South African gentleman" quoted by Lawson in a speech at a shareholders' meeting of the British Motor Syndicate in January of that year: "We do not care how the machines stink or vibrate; but will they go? If they will, we can take hundreds of them in the Transvaal. There is an enormous market for them".⁵⁴

Unfortunately, the machines, especially those just purchased by novices, often would not go: "Incredible as it may seem, many people who bought motor cycles in early times, did not succeed in starting the engine for several days".⁵⁵ Possible reasons for failing to start included gummy lubricating oil, ill-fitting cylinder heads, unreliable ignition, and petrol which "never gassed really furiously at low speeds".⁵⁶

When the machine had been started the problem was to keep it going. Before the development of the magneto, batteries would simply run down, so, ideally, a spare battery would be carried. Petrol would have to be carried

for the whole journey, or fuelling stops planned in advance at known suppliers, who were otherwise hard to find. But stoppages from other causes invariably occurred. Among these "The commonest was failure to climb a hill. The most baffling was an ignition fault. The most monotonous was a broken or slipping belt. All three figured in absolutely every single ride".⁵⁷

But what of particular makes? Some were certainly better than others.

The de Dion Type Motor Tricycle

The de Dion was an effective design if not altogether a good one. It was, however, almost certainly the most praised and written about motor cycle in all of the early journals catering to the industry, but this was not surprising considering that it was the prototype for the greater part of the industry's entire output for at least the first three or four years.⁵⁸

The first British copy of the de Dion, produced by Beeston, was very similar to the original except for the replacement of the de Dion's electric ignition by a hot tube, a rather retrograde step. Hot tube ignition was dangerous and not particularly efficient. In operation it meant that engines could only run at maximum speed. In a spill it could cause a fire, and according to BHD, "as a rule, the burner ignited the carburettor within a month of purchase".⁵⁹ However, at a time when electricity was little understood by most people, the mechanism of a burner was simpler for the average rider to handle than electric ignition which, when it went wrong, would in most cases leave him quite baffled.

Yet both systems needed care. In "Notes on the Management of Motor Tricycles", Dr T. Pritchard Roberts wrote that with tube ignition "a little tact is required to keep the lamp in good order", and he goes on to list a number of operations needed to maintain the burner.⁶⁰ Thus there could be maintenance problems even with a hot tube.

Electric ignition was favoured by H.O. Duncan, but he

also discovered it was not without its difficulties, and only learned to master it himself after "having almost to pick my machine to pieces to get the thing to go".⁶¹ As he noted, electric ignition "does not require many hours to thoroughly understand it".⁶²

Thus there may have been sound commercial reasons for Beeston to revert to hot tube ignition, but de Dion remained faithful to their electrical system, saw it through its teething troubles, and sold many more machines than any one else.

What the early British imitators of the de Dion tricycle did not do was change in any way the basic layout of the machine. The engine remained in its original position behind the rear axle. This was poor design practice, yet published material up to 1899 gives little indication of dissatisfaction with it. Technical writers nearly always described the machine and its layout uncritically, and as late as 1900, A.J. Wilson, a writer with twenty years experience of the cycle industry and an acknowledged expert on motor cycle technology, appeared to be referring to the de Dion type tricycle when writing about what he considered to be the ideal motor cycle.⁶³

But eventually the tide of opinion began to turn: "The motor tricycle is at best a makeshift arrangement, and gives to the onlooker the idea of a petrol motor having been tacked on to a standard tricycle construction".⁶⁴ See again fig. 7.2. Such machines, however, were not without their satisfied riders. A letter from the rider of a New Beeston tricycle stated: "it never gave the slightest trouble, did twenty miles easily in a little over one and a half hours, and ran up hills of, say, one in twenty without pedalling, and up hills even as steep as one in nine or ten with hardly any muscular help. I am most amazed at the economy of working; forty miles with about three pints of petrol, or about ten miles for one penny".⁶⁵

Thus it would seem likely that to somebody with little previous experience of motor vehicles, the gains were sufficient to enable him to overlook the vices of a machine

which, according to BHD, was so constructed that "at speed any wee bump in the road flung the wheel up, and the trike tried to fall over backwards like a rearing horse".⁶⁶ The Ariel was the first machine to overcome this fault.

The Ariel Motor Tricycle

The Ariel, designed apparently with reference to what was already known about the de Dion, was a far better machine. It had a slightly longer wheel-base and a centrally placed engine which gave it much greater stability. It was soon recognised as the best motor cycle of its day, and in 1899 J.W.Stocks, a former racing cyclist, set out on an Ariel to discover what it could do. The summary of the published account of his run which follows,⁶⁷ illustrates not only the capability of the machine but also the pioneering spirit that was essential to the rider of early motor cycles.

Starting from Yardley, just outside Birmingham, at 6.15pm, Stocks chose a route to Doncaster via Barnet, intending to return the same way, a total of 488 miles, while avoiding "the picked roads usually chosen by cycle record breakers". He reached Barnet at 11.00pm only five minutes later than scheduled, a distance of 94 miles in 4 hours 45 minutes.

Between Barnet and Hitchin he lost his way in the dark and reached Hitchin at 1.00am, an hour late. At Hitchin he refuelled and had a meal before leaving for Doncaster which he reached at 7.40am, but by now he was 1 hour 45 minutes behind schedule. More time had been lost partly because of "the intense darkness between 11 pm and 2.30 am"—the Ariel's lights would not have been very good—and partly because near Retford, an inlet valve pin had worked out allowing the valve to fall onto the exhaust. The repair was a simple one but it took 25 minutes, most of which was taken up in allowing the engine to cool before it could be handled.

The return journey to Barnet was completed at 3pm "having covered 396 miles in twenty and threequarter

hours". After turning for home, Stocks had covered another 25 miles when the inlet valve again gave trouble, causing another stoppage of 20 minutes. A few miles further on at Stony Stratford, the valve stem fractured and the valve was now beyond repair. The time was 5.15pm and 434 miles had been covered in twenty-three hours, but the machine was now disabled and could not be repaired without a new valve which was not carried.

This was an outstanding performance for the period. Average speed was 19mph, which meant maintaining top speed most of the way. The rider was unaccompanied and made arrangements for food and fuel, apparently in advance, at only two places, Hitchin and Doncaster. The inevitable breakdowns occurred, however, and it is perhaps surprising that there were not more of them, but riders soon found the remedy in carrying a large collection of spares.

Stocks' run marked the heyday of the motor tricycles and they would soon be of diminishing importance, as better two-wheelers became available.

The Motor Bicycles

Motor bicycles had several advantages over tricycles. They were lighter, cheaper, easier to store and more economical to run. One of the earliest reported runs on a motor bicycle was undertaken by a "lady autocarist".⁶⁸ Riding a new machine (fig. 7.8) produced by the Coventry Motor Company, she covered the 93 miles between Coventry and London "over shockingly muddy and heavy roads, in nine hours, including stoppages for her escort, as well as the necessary halts for refreshments".

This was an experimental machine with transmission by a form of ("The Autocar", 11 September 1897)

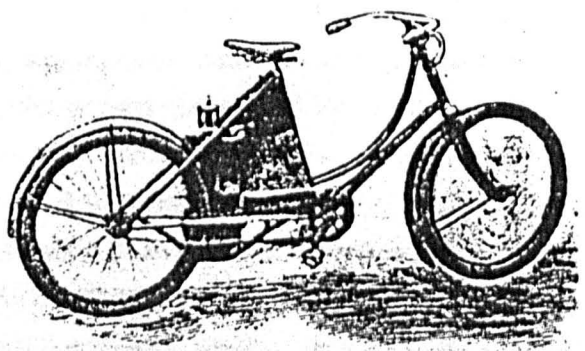


Fig. 7.8. Coventry Motor Company
Experimental Motor Bicycle

friction drive acting on the rear tyre which, as was reported years later, "was worn through almost to the inner tube".⁶⁹

At much the same time, Mr S.F. Edge who was involved in the industry, lent a motor bicycle to a friend who was described as a "mere bicyclist". The machine was said to be "one of a practically obsolete type, which had to be started by running along side, and which was altogether harder to manage than the present perfected types such as are turned out by the Beeston Motor Co. or the Coventry Motor Co."⁷⁰

The friend wrote of his experiences to Mr Edge in a letter dated 6 October 1897, which was subsequently published.⁷¹ Some extracts from it follow:

This was my second ride on a motor. Part of the time I was in a considerable state of funk, as Croydon was all but under water, and I pictured myself having a sideslip with a few hundredweight of motor bicycle on top of me. It is difficult to keep it slow enough for town and night riding. The only way I find I can do it is by turning off the sparking for a few strokes and then turning it on again. It caused three horses to run away.....I spent practically the whole evening having my first experience in the repair of ——tyres.....Today's excitement. I started off rather badly, as it is not the easiest thing in the world to shove a 135 gear on a 120 lbs. bicycle, steer with one hand, stoop down, and manipulate the tap regulating the air supply.....I came to a hill out Shirley way. This I failed to mount the first time, so I turned the machine round, ran down the hill, and went at it at a faster pace. I got up it with the greatest of ease.....going down West Wickham Hill.....the pace had got up to I should think, twenty miles an hour. I rang the bell, yelled loudly.....Luckily the hill was clear. What added to my fright was the fact that the brake would not act.....When I had got halfway down the hill something gave a jerk in the brake and it came into action, so much so that there was a strong smell of burning

rubber, and sundry lumps were chipped out of the non-slipping band you had fitted to it.

Whether or not this was a "practically obsolete type" rather than one of those "present perfected types", the problems encountered were typical of almost all motor bicycles at that time. Starting was not easy, the brakes did not work, it was difficult to regulate the speed, and it was of very poor performance going uphill. The Werner may have been no more comfortable to ride but it did perform better.

The Werner

As we have seen, the Werner was simple in design. The engine was perched in front of the steering head directly over the front wheel, an arrangement which one writer described as "daringly ingenious, but totally incorrect in principle".⁷² As a result, the machine had a tendency to sideslip which, combined with the hot tube ignition of the earlier models, could create a dangerous situation for the rider. Nevertheless, it led the field and set an early standard for others to emulate: "it will be necessary for the success of any machine of the kind that it has reliability equal at least to the Werner we have at present in use".⁷³

Riders' experiences, as reported in published letters, were varied but for the most part favourable. One correspondent, found his Werner "a charming little machine used in the right way, and with care not liable to any accident that an ordinary bicycle would not be liable to".⁷⁴ He did advise caution, however: "who would ride a bicycle over greasy roads at any pace above a few miles an hour, or go sharply round corners?"⁷⁵ Another praised the Werner for its "simplicity, fast running and reliability" and reported a run from London to Brighton in three and a quarter hours.⁷⁶

The most impressive run on an early Werner, however, was undertaken by Mr Hubert Egerton, who was the first to ride from Land's End to John-o'-Groat's on a motor bicycle.

It took him four days eight hours during which he covered almost nine hundred miles at a cost for lubricating oil, petrol and battery power of less than a pound. He reported little trouble with skidding even in wet conditions and few technical problems except for the inevitable puncture and a badly damaged rear tyre caused by a loose mudguard.⁷⁷

The Werner then was a useful machine in the hands of experienced riders willing to take care in difficult conditions, and possessing the technical skills to perform necessary roadside repairs, and the foresight to carry various spare parts with them. It could take them by road almost anywhere they wanted to go, except up the steeper hills, and at better road speed than they had ever experienced before. But not all riders were so experienced and not all rides on Werners were so trouble free.

As BHD recalls, a ride on a Werner could be quite harrowing: "One very wet day I watched a soaked and dirty figure attempt to ride past Carfax. He skidded, and fell heavily, as well he might, for the machine was very tall and carried all its mechanism on a small platform above the front wheel, while his tyres were practically bald. As soon as the machine lay flat, it caught fire and burnt furiously. Small wonder, since much of its petrol was spilt from the tin swish-box which formed its carburettor, while the ignition consisted of a platinum tube rendered incandescent by a petrol burner. This front-driven Werner pardonably impressed me as a unnecessarily complicated form of suicide".⁷⁸

The Singer

By the time the Werner had been converted to electric ignition, the Perks and Birch "Compact" (later known as the Singer) had appeared equipped with a magneto. This was in both practical and commercial terms probably the first really effective British designed motor bicycle to go into production. The engine and all its necessary supporting functions were built into the rear wheel, which made the machine more like a standard bicycle in appearance than any

other motor cycle. The result was a neat design with clean, familiar lines which were a good selling point and often noted.

In an early report on the machine before it had passed to Singer, what impressed the writer was its relative freedom from vibration, its speed and good performance on hills, and simplicity of control.⁷⁹ Under the name of Singer the machine was manufactured in standard form as a motor bicycle, and also as a motor tricycle, a tandem tricycle, a commercial carrier, and a 'ladies' motor bicycle. It would be interesting therefore to consider it from a female point of view as presented in an article by Isobel Marks.⁸⁰

The writer's extreme modesty belies her obvious competence. The Singer she found:

well suited to woman's but ofttimes limited knowledge of mechanics.....hill-climbing or running upon the level seemed equally within the compass of the bicycle.....in delightful contrast to the 'steering' of a horse, which exacts much skill, the guidance of this little bicycle is quite within the novice's power, for it is as amenable to discipline as our own beloved pedal-powered mounts..... Sideslip does not apparently cause any more trouble than that to which the bicycle of everyday life is exposed when half-dried mud abounds. When nearing a grease spot—a not altogether rare occurrence for winter roads—a very slow rate of speed was maintained.....In a word my short experience served to show that the Singer motor bicycle has put within reach of cyclists a convenient, safe, and speedy means of long-distance locomotion..... anyone who can ride an ordinary bicycle can at once ride the Singer.

The Singer then did live up to its reputation as a simple machine to ride and control. What better recommendation could it have had than for a woman to ride it and write of it in such terms, at a time when women were still considered to be the weaker sex? Isabel Marks clearly knew what she was about, yet one doubts that the machine could

have been so free of vices. According to A.J. Wilson who still preferred tricycles, the Singer was in general a good machine, but its one great blemish "(as of every other motor bicycle hitherto) is the lubrication, and I am afraid that until this is improved the best class of riders—the class that will be attracted by the Singer—will speedily become disgusted by the unpleasantness of having to dismount, unscrew and screw up dirty plugs, and laboriously inject the thick slow-running oil into the crank chamber".⁸¹ Nevertheless, the Singer was still one of the best machines of its day.

Summary and Conclusions

Measured up against the list of hypothetical standards presented on page 120, few early motor cycles would have done well. Controls were often poorly designed, difficult to use, and located in inaccessible places. And even when such features were developed as far as was possible at the time, the basic technology of the machine was often too primitive to give the rider any real mastery of the road. He was also in trouble if, having mastered one machine, he bought another of a different make, since there was no standardization of control layouts. (This matter did not even arise as a topic for serious discussion until about 1914.) The Singer was noted for ease and simplicity of control, but it came late in the period and was certainly untypical.

Starting was often extremely difficult. With hot tube ignition the tube had to glow red before the engine could fire, and then, as with electric ignition, the machine would usually have to be pushed or pedalled some way before it would start. This would require considerable muscular effort even with the lightest motor cycles. Once started, few motor cycles could keep going for any length of time. A stall was inevitable in slow traffic because of the lack of a clutch or variable gear, and breakdowns were frequent.

If they did keep going, however, most machines were capable of fairly good performance on level ground, but few

could ascend hills without difficulty. Tackling a hill nearly always meant assisting the engine with vigorous pedalling, and then the outcome might depend as much on the rider's strength as on the power of the engine.

Few machines would handle well in traffic, not only from the lack of variable gears, but because many had engines which could only operate at maximum speed. In slow traffic this might mean switching off the engine and relying on the pedals—not a pleasant prospect with a machine usually at least four times the weight of a bicycle.

Early motor cycles were notoriously unstable. Even tricycles could turn over, especially the de Dion type, but they were far more stable than the two-wheelers. Almost any two-wheeler would "lay down" on a muddy road, but this was at least as much a result of the road surface as poor design. On modern roads even machines like the original Werner with the engine over the front wheel, can be ridden safely, and there is a French made moped, the Velo-Solex, with the engine in this position, which has been a best-seller for the last thirty years.⁸²

There was much then to deter the would-be motorcyclist. Those who were not deterred, and not in the trade and riding motor cycles to prove how simple and safe they were, had to be enthusiastic, willing to take a risk and not over-concerned with comfort. But they did not have to be record breakers. There were signs, judging by some of the published letters, that there were some people who studied motorcycling and what it could do for them, how its dangers could be minimised and its utility increased. These were the pioneers, and, equipped with heavy leather coats, "leather chauffeur's cap with shiny peak, without which nobody ever dreamt of taking the road",⁸³ various tools, numerous spare parts and a spare battery, they could and did make good use of motor cycles. They were few, and fortunately for the embryonic industry, rather long-suffering. As BHD observed some years later: "Not a single machine would ever have been sold if the trade had frankly

informed customers of the exhausting experience which awaited them on the road".⁸⁴

This does not mean that the industry was indifferent to the plight of the motorcyclist. What it means is that a new industry cannot grow up overnight. It was relatively simple to develop some kind of working motor cycle, but it was not at all simple to manufacture motor cycles which would sell in sufficient numbers to make a profit. Much still had to be learnt about motor cycle technology before it would be possible to produce a machine that would satisfy the consumer.

People in the industry, however, were not always willing to recognise the true state of the art. Rather they tended to be overoptimistic about their products and what it would take to create a viable industry. A published letter from Metropole Automobile Supply Syndicate identifies at least part of the problem: "The initial fault, that there is no sudden stride made in the industry in this country, seems to the writer to be that the experimenter expected his expenses to be refunded by turning out his first lot of goods".⁸⁵ Thus many manufacturers rushed their new products onto the market at the earliest possible date without giving sufficient attention to even the most basic requirements of good design and development. Motor cycles which were described as "perfected" were usually uncomfortable to ride and extremely dangerous except in the most favourable conditions. But there was hope for the future. Some idea of what was to come was presaged by a comment in "The Cyclist": "out of our late experiences with both 'Singers' and 'Werners' we are bound to say that motor bicycling is glorious fun, and the pleasure hugely outweighs its own peculiar little drawbacks".⁸⁶ It would be some years yet, however, before this claim could be justified.

The Experimental Products: Evaluation

The experimental products fall easily into two main classes, the motor tricycles and the motor bicycles. There was very little variation among the tricycles as they were nearly all based on the de Dion pattern, and thus the first standard, if a rather premature one, was the de Dion type tricycle. There was much more variety among the motor bicycles, because even when they were based on the standard bicycle, there was a great variation of engine position. It would be rather stretching a point, therefore, to call any one of them a standard, as in fact did happen at the time.

The propositions of Chapter 4 are well supported by the evidence, as follows:

3. In the earliest days of an industry the only requirement to ensure the marketability of a product is that it works, however bad its performance.

There is no doubt that the first commercially produced motor cycle, the H & W, did sell in substantial quantities, perhaps as many as 2,000 in 1894-7. This performance was particularly impressive in view of the fact that it was an entirely new concept product. The de Dion tricycle, coming onto the market two years later (1896), sold consistently well for several years though we do not know how many machines were sold in the first year or two.

As we have seen, neither of these machines performed well although the de Dion might have been considered adequate within the limited perspective and experience of consumers of the day. The H & W was difficult to start, difficult to ride, and unreliable, while the de Dion was unstable because of its rather poor weight distribution. Both were helped commercially because they came onto the market before potential consumers had any idea of what to expect or demand from a motor cycle. It is relatively easy for the consumer to rationalise away the significance of poor performance when he has no standard against which to judge his new purchase. Thus, poor as they were, these

early machines did sell for a time.

4. In order to survive for any length of time, a product must reach a certain minimum level of performance.

The de Dion tricycle clearly did reach this minimum level of performance as, together with many of its imitations, it was still being produced in 1900. It survived because of its reliability rather than its comfort. At a time when most motor cycles did not work very well or very consistently, one which kept going for any length of time was to be highly commended.

Better than the de Dion and also relatively long-lived for the time, were the Ariel tricycle, and the Werner and Singer motor bicycles which, whatever their drawbacks, were reliable machines of considerable popularity.

In contrast, the majority of other designs made only a rather brief appearance. The Pennington motor bicycle did not even go into production despite lavish publicity, and that of the Coventry Motor Company seems to have suffered a similar fate. The Beeston motor bicycle, a copy of a de Dion machine, did go into production but was soon found to be rather dangerous and withdrawn. There were many other machines which appeared very briefly on the market and of which little is known, like, for example, the sociable produced by the Burgess Cycle Company. Such machines were far short of that necessary minimum level of performance required for survival.

5. It will be difficult for earliest products to survive because new and better ones will soon be placed on the market.

The problem in dealing with this question is that we know so little about the less successful early machines. The clear case of a machine which went out of production at least partly because of the appearance on the market of a much better one, was the H & W which gave way to the de Dion tricycle. There were many complaints about the H & W so that the firm was in trouble anyway, but it was capable

of improvement and might just possibly have remained in production if it had not been for the de Dion: "what really killed the Hilderbrand and Wolfmüller motor-bicycles in that country [Germany] was the wonderful vogue of the de Dion-Bouton motor-tricycles".⁸⁷

As far as more successful machines are concerned, this proposition depends very much on the time-scale adopted. The de Dion tricycle, the early Werner and the Singer, all went out of production because better products came onto the market. But they all survived for at least three or four years. The reason for this is that while new products were being placed on the market all the time, the vast majority of them were not significantly better. Motor cycle designers, whoever they were, had little or no theory to guide them and would be more aptly characterised as experimenters than engineers. The de Dion tricycle and the Werner were in the nature of lucky experiments, and it was difficult to beat them until a more studied approach was applied to motor cycle design. Thus there was a particularly high degree of chance where the more successful early machines were concerned, and where chance rules logic is of little consequence. The one significantly better product to be developed in this period, the Ariel tricycle, did not rapidly replace the de Dion as would be expected. The reason for this is discussed in No. 7, below.

6. When there are no satisfactory products from the consumer's point of view, even poor products may be widely imitated and become premature, but acknowledged, standards.

The most important motor cycle of the period was the de Dion tricycle. This was widely imitated and became an acknowledged standard. The only point of doubt is whether it could reasonably be described as a satisfactory machine from the consumer's point of view. There was little or no published criticism of the de Dion at least until 1899. Technical writers almost invariably seemed to consider it a good machine. It is possible then that consumers found it satisfactory in its day since there was no other standard

against which it might be judged. We must treat this idea with caution, however, since most of the published comment at that time came from people who, even if they did not have trade connections, were at least sympathetic to the trade. Furthermore, the machine did have one major weakness in its poor weight distribution which, as we have seen in BHD's comments, could make it dangerously unstable.

The question of the de Dion's instability was not raised in the trade press until after the Ariel had been marketed. It is probable then that people only learnt how to be dissatisfied with the de Dion when they had something better with which to compare it. If we look at it with any degree of objectivity, however, it is clear that it was of poor design, technically unsound, and potentially dangerous to ride. Yet it became a standard, albeit a rather premature one.

7. Premature standards which gain the loyalty of the consumer will be able to resist for a time competition from better products because of the typical consumer's tendency to caution.

The one case which illustrates this proposition is the relationship between the de Dion and the Ariel. The de Dion was the original, the first machine to be successfully marketed, and ultimately, the famous name. When it came onto the market it replaced the H & W, which was at the time a subject of many complaints, and it proved to be a much better machine. The Ariel came from a well known firm of cycle manufacturers, but when it was first put onto the market it had to compete with the relatively long established de Dion which was considered, at least by the trade press, a rather good machine.

It is not altogether surprising, therefore, that initially the Ariel met with criticism which was less well informed than it appeared to be, and such criticism may have slowed sales. But what was probably of greater significance was the fact that even after it had gone into production, manufacturers were still entering the industry

to produce their own versions of the de Dion and still managed to sell some machines. In other words, consumers were still willing to buy the de Dion and it remained the recognised standard tricycle until tricycles in general began to give way to motor bicycles.

Conclusions

What is it that can turn a collection of rather improbable experimenters, engaged in producing some even more improbable machines, into an industry? The vast majority of experimenters rarely achieve anything of lasting significance and very few of their inventions can be turned into viable products. Of those inventions that are put into production, few ever achieve commercial success. Those that do, however, will be imitated or manufactured under licence so that very soon by far the greater part of the industry, in terms of the number of producers, will be made up of imitators rather than experimenters. Experimentation or invention, therefore, is no more than the first step. It does not create an industry. But neither does mere imitation. The imitators also must be successful before the industry is likely to become viable.

Before an imitator can be successful he must be capable of manufacturing a product at least as good as that which he is imitating and preferably one that is rather better. Otherwise the advantage must remain with the originator of the new product since he will have a much better command of the necessary technology and he is likely to receive particularly favourable publicity for his originality. Most of the would-be imitators of the de Dion tricycle, however, lacking the extensive experimental experience of de Dion-Bouton offered products which not only failed to match the original but were inferior to it.

Nevertheless, some British firms were capable of producing a reasonable copy of the de Dion, but in the final analysis they were let down by the product itself. de Dion tricycles were just not good enough to attract enough buyers to support and sustain an industry. Most

British firms involved in the motor cycle industry up to 1900 almost certainly produced no more than one or two machines a week, and it is doubtful if even the most successful had an output of more than five or six a week, and there were very few who could have achieved this level of output.

There was hope perhaps for firms which, starting with the basic de Dion model, set out to develop something substantially better and which would overcome the de Dion's weaknesses. The only machine to emerge as a result of this kind of effort was the Ariel. The Ariel was of high performance but expensive to develop and arrived on the scene too late in the day: by the time its superiority was recognised, the two-wheeler was beginning to replace the tricycle. This demonstrates the particularly high risk of product development in the early days of an industry before it is known which type of machine is likely to predominate in the future. The producer of the Ariel was not the only firm to spend a considerable amount of capital on development, but it was the only one which had anything at all to show for its efforts.

In contrast, the development cost of the first successful motor bicycle, the Werner, was minimal, but this was another of those quickly put together experimental machines. The Werner was even more improbable in design than the de Dion tricycle, but two-wheelers had obvious advantages over tricycles particularly when it came to price, simplicity of construction and weight. Thus it was only necessary to demonstrate that the two-wheeler was a practicable machine in order to generate a renewed interest in it. This above all else was the achievement of the Werner, and although it did not inspire a spate of imitations as did the de Dion, it must have helped to set in train in many minds the thoughts that, only two or three years later, would lead to the invention of machines which could with further development meet the needs of consumers.

Satisfying the consumer is always the key to successful product development. For this reason the best way of

judging the viability of a new industry is to study the response of the consumer to the new products. So long as the consumer is dissatisfied, there is little chance of an expanding market, and so long as the market remains small, the industry will remain small and its future in doubt. Despite the many favourable comments about motor cycles that were published in the early days of motorcycling, it is doubtful that very many people were satisfied with machines such as the de Dion and the Werner, and those that were were probably for the most part in the category of "adventurers" or record-breakers rather than ordinary people trying to go about their normal business with the aid of a motor cycle.

The failure of producers to manufacture safer, more comfortable machines was not a result of callousness where the consumer was concerned, but rather a lack of the technical competence to produce anything better. It was easy enough for the manufacturer to rationalise to the effect that consumers did not want electric ignition, when he himself did not fully understand how it worked. But in these circumstances, how was it possible for the manufacturer to produce a machine with electric ignition which did work? At this stage, therefore, the future of the industry depended initially not on giving more attention to the needs of consumers, but on learning more about motor cycle technology.

As we shall see in the next chapter, the necessary learning was not the easiest thing to acquire.

CHAPTER 8

THE DEVELOPMENTAL PHASE, 1901-1907

The purpose of the last chapter was to consider the beginnings of the industry and the experimental machines on which it was based. The period then was one of trial and error out of which few firms achieved much in the nature of commercial success. Those firms which were successful were the lucky ones since no one knew in advance which machines would be of more than experimental value and whether or not such machines would sell.

Against this the developmental phase began with the emergence of the first machines that were likely to be more than just experiments and which had the potential in terms of two factors, basic soundness of design and the possibility of widespread acceptance by the consumer, to be developed into long-term standard products.

It was not obvious when these new types of machine first appeared that one or more of them would dominate the market in the future, and so the first two or three years of the developmental phase were still a period of trial and error for many firms before the new Werner type was finally adopted as the recognised standard. It was only then that development began in earnest, development that is in the sense of a systematic effort to improve an existing type of machine.

This chapter is to a large extent the story of that effort. It begins, however, with an account of the growth of the industry. This is followed by an examination of the progress of the developing standard from a technical point of view and a discussion of the different approaches to product development of two firms, one of which concentrated on the developing standard while the other preferred to develop more innovative products.

Later parts of the chapter deal with the consumer

aspects of motorcycling during the period and an evaluation of the developing standard in terms of the propositions of Chapter 4.

Introduction

In 1901, the majority of motor cyclists who had given up their motor tricycles for two-wheelers, were still riding machines like the original Werner with the engine perched precariously over the front wheel, and the Singer with the engine built into the rear wheel. Effective as these pioneering machines could be, they bore little resemblance to the motor cycles which would emerge within a few years.

By 1907 the motor cycle had already evolved into the standard form which would eventually become almost universal. This period then was one of the most significant of the industry's entire history for the development of its product. It was less significant, and in some ways disappointing, for the development of the industry itself. The major problem was entry: how to enter the new industry and make it pay.

Entry

In order to succeed as a motor cycle manufacturer, a company needed several things including technical know-how; an appreciation of the market and the ability to recognise what kind of product would sell and what would not; and, most important of all, sufficient capital or financial strength from other operations to be able to survive at least a year of substantially reduced profits and probably a loss.

Few companies could fulfil these requirements, and even for those that could, motor cycle manufacture was still an extremely hazardous undertaking. The motor cycle was still a rather unreliable machine. In expert hands it was capable of good performance, but it was as yet far short of the kind of product that would appeal to a wider market. In their appreciation of the situation towards the

end of 1901, "The Cycle Trader", responding apparently to calls from other sections of the press for an expansion of output, warned that the demand for motor cycles was still rather limited and that:

In this instance enterprise must be tempered with caution. If the trade responds to the cat-calls of some writers, every cycle manufacturer will be busy for the next few months making elaborate arrangements for an extensive output of motor bicycles next season. To do anything of the kind at the present stage would be the height of folly. The limited demand, instead of trending in the direction of two or three makers who were early in tapping it, will be absorbed by a hundred and one applicants.....At the inception of the movement competition threatens to be lively, and already we hear of impending introductions and paralyzingly low prices.¹

The warning went largely unheeded but its prophetic element was borne out by what followed. Only five months later it was reported that 80% of cycle firms had started motor bicycle production.² Before the end of 1902, "Motor Cycling" had noted, first that "More conservative firms are now fully satisfied that the motor-bicycle has come to stay and are busy preparing their new patterns for the shows",³ and then that "practically every cycle manufacturer of any reputation" had sent one or several motor bicycles to one of the cycle shows.⁴

The majority of these producers were assemblers rather than manufacturers, and turned out their machines almost entirely from parts manufactured elsewhere.⁵ This development was promoted particularly by manufacturers such as the Belgian firm, Minerva, which offered kits of parts containing everything required to convert the standard safety bicycle into a motor cycle. The result was that the majority of firms which entered the industry in 1901-2, began with a Minerva pattern model which was usually powered by a Minerva engine, thousands of which were sold. Few of the newcomers, however, sold many machines or achieved much of a profit from their efforts.

GRAND

£25 OFFER



OUR OFFER.

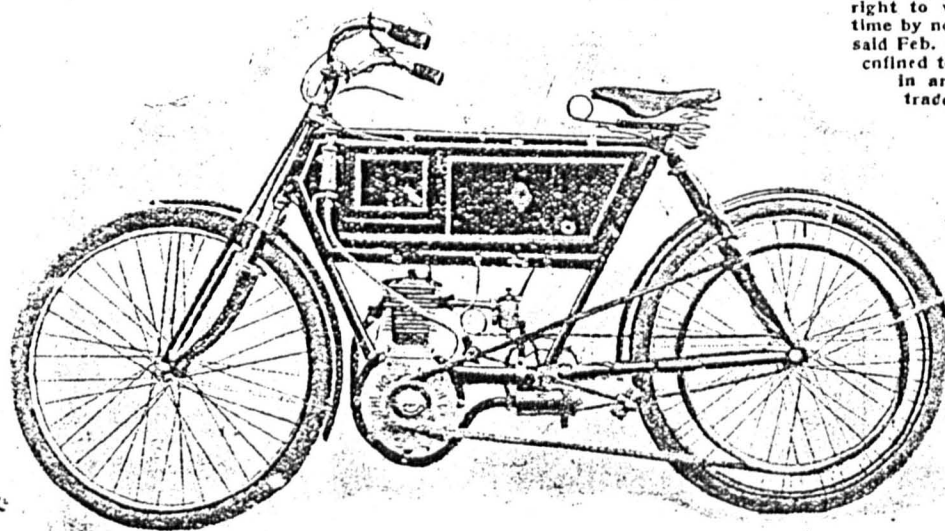
We offer to any intending purchaser, subject to the following terms, one of our £34 Standard 2½ b.h.p. 1904 Motor Cycles at a reduction of £9, making the price of the machine £25.

Terms: We agree to supply one of our £34 machines at the above price, viz., £25, to the first approved applicant in every town or village in the British Isles, and who must be in every instance a *bona fide* private buyer.

No order will be accepted until our terms for this special purchase are complied with. This offer will be closed by notice in our advertisement the week previous to its withdrawal, and will not, under any circumstances, extend later than

February the 18th, and we hold the right to withdraw this offer at any time by notice in this paper before the said Feb. 18th. This offer is absolutely confined to private buyers, all persons in any way connected with the trade being exempt. All applicants should at once write for particulars.

The only reason for our making this grand offer is to have one of our 1904 Motor Cycles in every town in Great Britain, as we are absolutely certain that these machines will secure us further orders if seen by any intending purchasers. A great number of intending purchasers are often afraid to place an order for low price articles. We are quite prepared to give a written guarantee with every machine, and we are open to state that these machines are equal to any machine advertised at from £45 to £50.



SPECIFICATION.

Engine 2½ b.h.p. with mechanical Valves and special relief Cam, as described in the "Motor" of December 29th. The Frame is a genuine Chater-Lea, wheels enamelled black, Frame 23in. only, with 26in. or 28in. wheels, D. R. Carburetter, Chicago Rawhide Belt, specially effective and efficient Silencer, Tank with three compartments, lubricating oil, cupboard for two Accumulators and Coil, and capacity for about two and a half gallons of petrol, P. and R. celluloid Accumulator, high speed Trembler Coil, Brown and Mason Switch, Chater-Lea Front Rim Brake, and Bowden Back Brake, good motor Saddle, and almost any make of Tyres. The above block represents the machine. Tank can be enamelled any colour. Plated Rims and lining out, 20/- extra.

NOBLE MOTOR CO., Pocock St., Blackfriars Rd., London, S.E.

Works and Factory: Pocock Street and West John Street, Blackfriars. Manager: H. J. HEASMAN.

Telegraphic Address: "Ignosco, London."

Telephone No. 2,080 Hop.

Fig. 8.1. Noble Motor Co. Advertisement
("The Motor Cycle", 26 January 1904)

As the "The Cycle Trader" had predicted, by 1903 or 1904 there were too many firms serving too limited a demand. Competition was fierce and price cutting so severe that the same journal doubted that manufacturers were even covering their costs: "enormous capital has been sunk in experimental work, and.....it will take a long time to recover that capital with a proportional interest in its outlay, unless the price of motor bicycles is kept up. The time has not yet come when the net cost of production establishment charges can be fairly booked against any make of motor bicycle.....we believe that many of the machines which have been put on the market and shown at the shows have been priced at a figure which has been actually below net cost of manufacture".⁶

One firm which sold motor bicycles at a particularly low price was Noble whose machines, of up-to-date design and reported to be of good performance, were made to sell at £34—already a low price—but were offered in limited quantities at £25. As they state in their advertisement (fig. 8.1), a typical price for such a machine was £45 to £50.

Year	Entered	Left	Remainder
Before 1901	24		
1901	26	5	45
1902	50	4	91
1903	42	12	121
1904	18	11	128
1905	16	20	124
1906	6	31	99
1907	8	11	96
Totals	166	94	

Table 8.1. Firms Entering and Leaving the Industry 1901-7⁷

In the period 1901-7, as can be seen in Table 8.1, 167 firms entered the industry, 92 of which entered in 1902-3. But by 1905, as a result of the slump in the industry, more firms were leaving than entering it.

The majority of these firms were short-lived as motor bicycle producers, and as Table 8.2 shows, 90 of them, 54%, were active in the industry for not more than 5 years, and only 47, 28%, for 10 years or more.

Duration	Number of Firms	%
Not more than 1 year	18	11
" 2 years	8	5
" 3 years	16	10
" 4 years	28	18
" 5 years	20	12
" 5 years (cumulative)	90	54
6-10 years	30	18
More than 10 years	46	28

Table 8.2. Duration of Continuous Motor Bicycle Production for Firms Entering the Industry 1901-7⁷

The cause of the slump, at least initially, was overproduction rather than any falling off in demand.⁸ Later, a boom in the motor industry which also led to overproduction and substantial price-cutting,⁹ may have persuaded many potential motor cyclists to buy cars instead.

The number of firms entering the industry, therefore, is somewhat misleading as a guide to the industry's growth. Production figures, even estimates, would be a better guide. For example, from about 1903 onwards, the number of firms in the industry was never much less than one hundred. This would indicate that for an annual output for the industry as a whole of 10,000 machines, the average output per firm would have been no more than 100 or about 2 machines a week, hardly enough to promise long term

survival. Production at this time was almost certainly not much more than 10,000 and might have been less.

There are no reliable production figures but we can get some idea of output from registration statistics. From June 1904 to June 1905, the number of motor cycle registrations increased from 21,521 to 34,706, a total of 13185.¹⁰ As the excess of imports over exports in 1905 was just over 1,000 machines,¹¹ output in the industry could have been near 12,000. But registration figures are always inflated by transfers of old machines, and actual output therefore is likely to have been a good deal lower.¹² Whatever figure output had reached by 1904, it was declining by 1905 with the increase in registrations down to 11,029 in 1905-6 and 8,142 in 1906-7.¹³

However, the decline in the industry may be exaggerated by these figures. Following adverse comments about the state of the industry in the national press, "The Motor Cycle" surveyed some of the more important firms for their comments. Of these, Phoenix claimed to be working overtime to meet demand; Triumph said they were "exceptionally busy on motor bicycles, and have turned out much larger numbers than last year"; Rex said "The demand, instead of diminishing, is greater by threefold than it was a year ago"; and Singer was "busy with motor bicycles".¹⁴

But while these firms were doing well, others were falling by the wayside: "The main fact that struck a visitor to the 1905 Stanley [Show] was the death of the waster. The firms that manufactured motor bicycles in an amateurish sort of way, who had no practical riders on their staff, and very little enterprise in their brains, have either died a natural death or have confined their enterprises to fields with which they were better fitted to deal, and the makers who exhibited are good examples of the survival of the fittest".¹⁵

Such firms did not necessarily fail because of poor products. An overcautious approach and poor marketing could be at least as important: "Among the 'dead' British firms there are some who made as good a machine as any of

the foreign ones, but they entered the field so timidly. They planned a small output, which could only repay them if expenses were rigidly curtailed, competitions avoided or left to purchasers' enterprise, press advertisements confined to an insignificant paragraph in the 'miscellaneous' column".¹⁶

Thus the reduction in the number of firms in the industry was at least partly offset by the improved commercial performance of the leading ones. The leading firm in terms of output was Rex which advertised extensively and boasted a production capacity of 4,500 machines a year. It is unlikely, however, that they ever came anywhere near to this figure, and the best annual output reported in the press was only 2,000 machines some of which were second-hand.¹⁷ Just how many of these were new is not known. The second-hand machines had been taken in part-exchange for new ones and then resold after being reconditioned.

Rex was the most aggressive company at that time when it came to marketing. For several years they offered allowances of from £25 to £40 for an old machine of certain specifications against the price of a new one costing a little over £50 (fig. 8.2). This effort is said at one time to have brought them near to bankruptcy,¹⁸ but for the most part it paid off and they were able to claim an output equal to that of the next three largest manufacturers.¹⁹ Which firms they were referring to and how much they were producing was not made clear, but Rex's claim suggests that there were at least three other firms producing something like 500 machines a year.

Rover and Triumph are the only firms for which there are definite production figures in this period. Triumph produced about 300 machines in 1905,²⁰ while Rover produced 1250 machines in the three years, 1903-5.²¹ This was quite good given the state of the industry at the time, but it was not good enough for Rover who gave up motor cycle production in 1905 to concentrate on bicycles and cars.

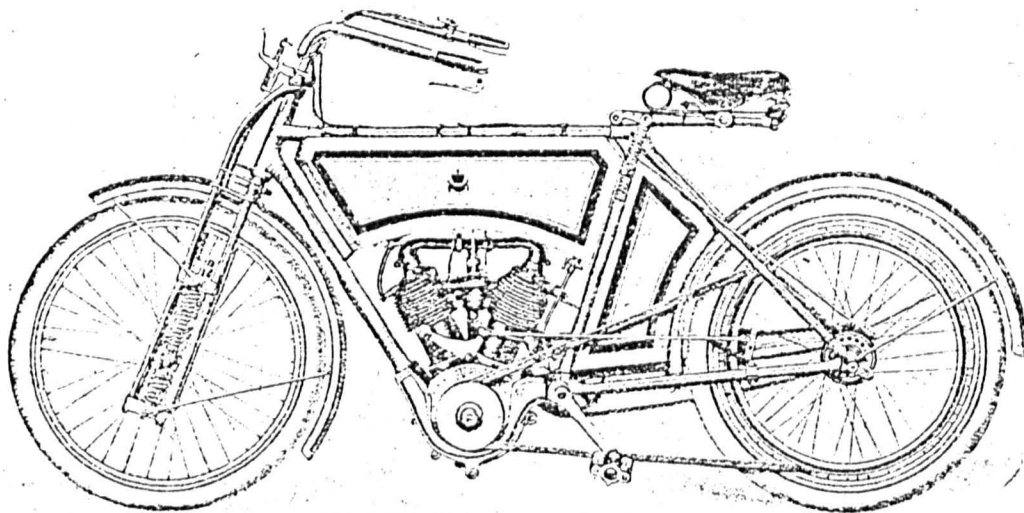
The slump in the industry saw a substantial decline in output to only 3,700 in 1907.²² However, a few firms and

THE REX EXCHANGE

— £32 10 0. —

THIRTY-TWO POUNDS, TEN SHILLINGS, allowed for a certain period on 3½ 1905 Rex machines, in part payment for the new 5 h.p. twin-cylinder, with spring fork and cantilever spring back. Price 50 guineas.

TWENTY-FIVE POUNDS allowed on 1905 machines by other makers in reasonable condition.



1906 TWIN-CYLINDER SILENT REX, 5 H.P.

Runs as smooth as water.

DECLARATION COUPON.

I declare my machine to be as follows:

Make

H.P.

Transmission.....

Condition.....

Tyres

What is your best allowance on exchange for Rex 1906 5 h.p. Twin-cylinder?

Name

Address

REX AGENCY:

STORE STREET,
TOTTENHAM COURT ROAD,
LONDON.

ALL MODELS STOCKED.
REPAIRS AND SUNDRIES.

Rex Motor Mfg. Co., Ltd., Coventry.

Fig. 8.2. Rex Advertisement

("The Motor Cycle". 8 January 1906)

particularly Triumph continued to do well and carried out major development work to improve their products, so that by 1907 many of the technical problems of early machines had been overcome. Only five or six years earlier, continental manufacturers, especially the Belgians and the French, had led the world. Now, a commentator at the Paris Show was able to report how much better British machines were than foreign makes: "The English machine is better fitted and finished, the levers do not work loose, the controlling wires do not break, the brakes are more powerful and need less attention - in a word, the whole machine turned out by the British manufacturer seems built to last".²³

Thus the outlook for the British industry was much improved. Until then it had been growing in fits and starts. Short-lived boom had led to fairly long-term slump, and many firms which had only recently migrated from the cycle industry to motor cycles, very soon abandoned motor cycle production in favour of cars or had gone out of business altogether. Nevertheless, progress was being made. The contraction in the industry was temporary and, as will seen in the following section, was less significant than the improvement in its product. 1907 was the industry's low point in terms of output but the end of the year saw the first signs of recovery in the form of an increased demand for motor cycles and reports of manufacturers' plans to increase output.²⁴ Motor cycle registrations for 1907-8 were 11,149, 3007 more than for the previous year.²⁵

The Motor Cycle as Technical Product

None of the motor bicycles which were developed before 1900, except perhaps for one or two experimental models which never went into production, had the potential to be developed into a definitive standard. Machines such as the early Werner and the Singer were simply not sound enough in principle to be developed into products with sufficient consumer appeal to promote the development of a mass market. The necessary improvement in performance could not

come from small changes to existing models but required a radical redesign.

The first two potential standards, models with the basic soundness of design to be capable of development into definitive standards, appeared in 1900 and 1901. The first of these was the work of the hitherto unknown Joah Phelon, a Yorkshireman; the second, a new model from the Werners of Paris. Nevertheless, the design which dominated the industry in 1901 and 1902, was unrelated to either of these. It was the Minerva, a machine from a Belgian firm based on Antwerp.

The Minerva

The Minerva (fig. 8.3) was as simple in principle as the original Werner, but much more practical. It had electric ignition and belt transmission, but its most essential characteristic was the placing of the engine between the front wheel and the front down-tube, and clipped to the latter. This lowered the centre of gravity compared to the original Werner, and improved weight distribution compared with both Werner and Singer, thus producing a far more stable machine.

It was easy to assemble and the manufacturers were willing to supply all the necessary parts including the engine to any firm which wanted to convert ordinary safety

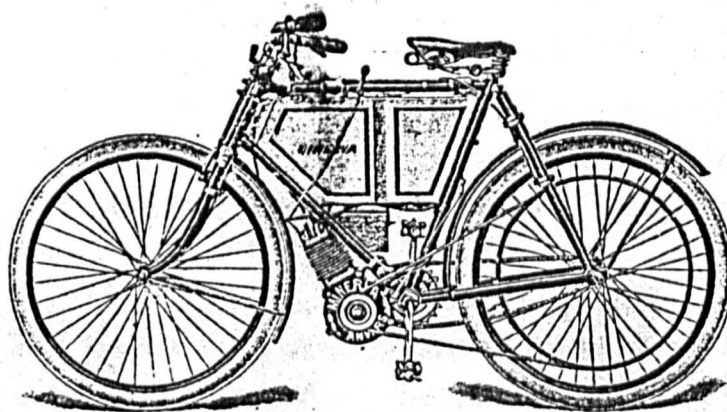


Fig. 8.3. The Minerva
("The Cyclist", 27 August 1902)

bicycles into motor cycles. The Minerva engine of 211cc, though small, was capable of propelling machine and rider at up to 35mph which was good speed in those days and even too fast at times given the state of the roads.

The Minerva was significant beyond its importance as a new design. The majority of firms entering the industry at that time did so with a Minerva pattern machine, although some adopted the same design but with other engines, while others used a Minerva engine in other positions.

The first British firm to develop a Minerva pattern machine was Bayliss Thomas, manufacturers of the Excelsior, whose first model was powered by a Minerva engine. This was followed by a more powerful machine, still of Minerva pattern but powered by a 2 $\frac{3}{4}$ hp MMC de Dion type engine. In order to accommodate the larger engine, the wheelbase was increased giving the machine a more advanced look (fig. 8.4).

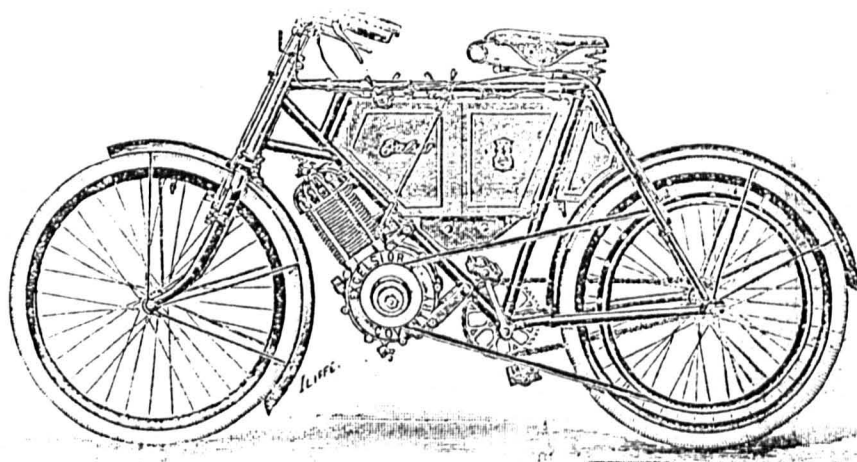


Fig. 8.4. The Excelsior "Minerva Pattern" Motor Bicycle
("The Cyclist", 10 December 1902)

With its new engine, the Excelsior performed very well. It won several competitions and set a new world record for the mile in 1902. It was also well thought of by ordinary riders, among whom was BHD, who, in order to demonstrate "the reliability of the modern motor bicycle", set out to ride it 200 miles in a day.²⁶

The Minerva appeared on the scene when, for the first time, and perhaps prematurely, British manufacturers were beginning to have some confidence in the future of the motor bicycle. It is not altogether surprising, therefore, that the Minerva pattern was adopted so rapidly by so many manufacturers. In 1901 an observer at the Stanley Show counted 48 Minerva pattern motor bicycles out of a total of 102.²⁷ Since the remaining 54 included a number of different designs, the Minerva was clearly the predominant type at that time.

In the first issue of "Motor Cycling", published 12 February 1902, 8 out of 18 motor bicycles illustrated in advertisements were of the Minerva pattern, while the other 10 represented six distinct types. Towards the end of the same year, A.J. Wilson, commenting on the cycle shows, reported that over a score of exhibitors were still faithful to the Minerva engine, presumably in a Minerva pattern machine, while there were "more than fifty exhibitors of motor bicycles no two of which were exactly alike".²⁸ Yet the overall pattern was already changing decisively in the direction of the new Werner, and only a year later a visitor to the Stanley Show reported "what may be termed the original Minerva pattern or position is now rather the exception than the rule, the majority of machines now having the engine vertically placed and more or less built into the frame and forming part of it".²⁹ Only one or two Minerva pattern machines were advertised in 1904, and during January 1905, every machine illustrated in advertisements in "The Motor Cycle" was based on the new Werner pattern.

The New Werner

As we saw in the last chapter, the Werner brothers developed the first commercially successful motor bicycle. It was an even greater achievement to develop the machine which became the prototype of the modern motor bicycle. They did this by shifting the pedals slightly to the rear and putting the engine in their place (fig.), which, as

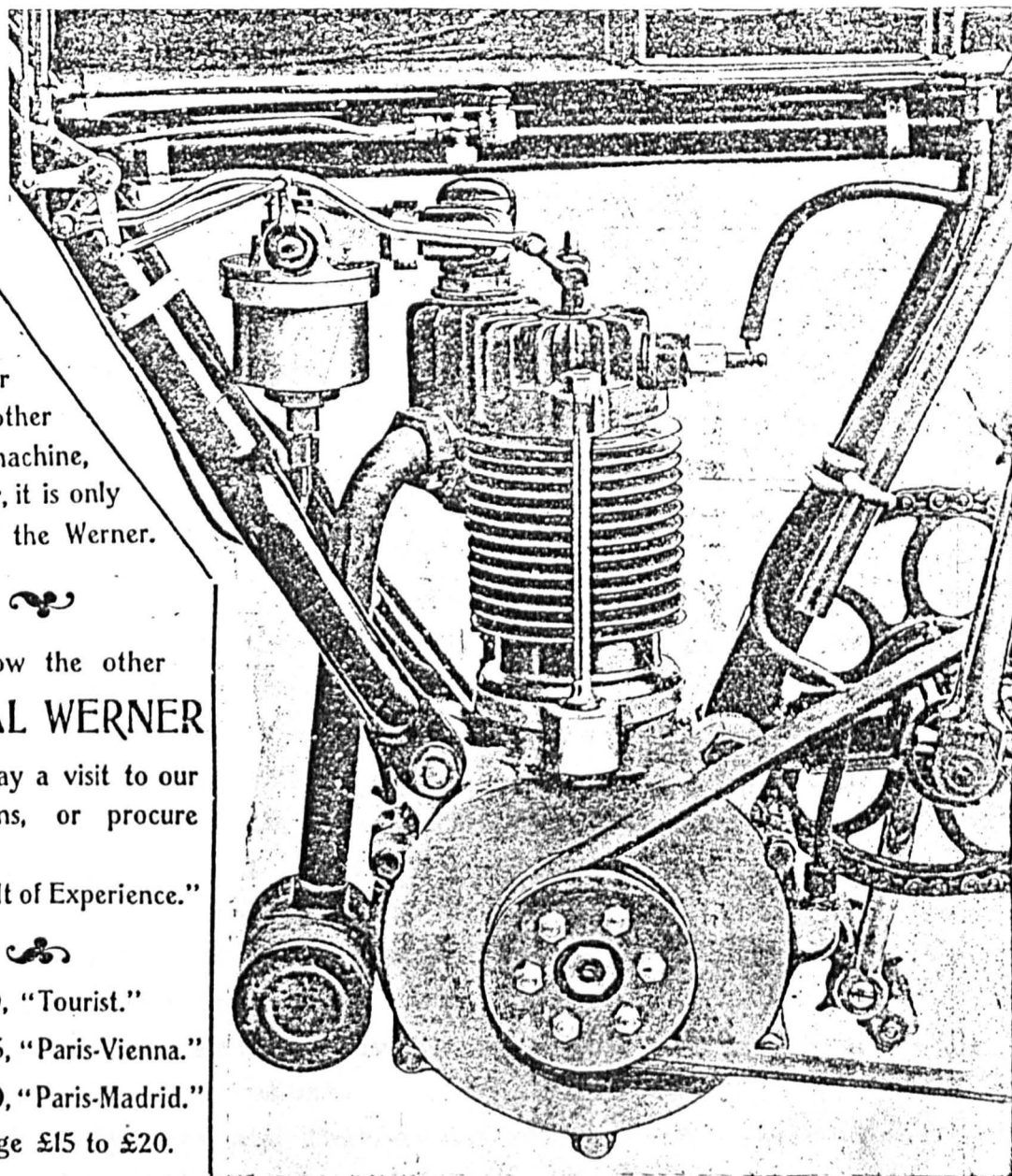
Think
of the

Werner

Every
time you
see the
engine
in this
position,
no matter
on what other
make of machine,
remember, it is only
a copy of the Werner.

To know the other
SPECIAL WERNER
features, pay a visit to our
Show-rooms, or procure
a copy of
"The Result of Experience."

2 h.p. £40, "Tourist."
2½ h.p. £45, "Paris-Vienna."
3½ h.p. £60, "Paris-Madrid."
Forecarriage £15 to £20.



WERNER MOTORS, Ltd., 151a, REGENT STREET, LONDON, W.

Fig. 8.5. "only a copy of the Werner"
("The Motor Cycle", 14 October 1903)

it turned out, was the most elegant and effective engine placing of all. Yet this may not have been fully realised at the time, since even the Werners themselves offered the new machine initially as an alternative to their older model rather than as a replacement for it. This probably explains why one or two firms still persisted for a year or two with their own versions of the original Werner.

In the new model, the engine was almost exactly central between the two wheels and as low down as practicable, thus ensuring good weight distribution, low centre of gravity, and far better handling than that of most earlier motor bicycles. The idea was not new. The engine placing was similar in Daimler's machine of 1885 (see Chapter 6), and also in the H & W and the Holden (see last chapter), although none of these machines was based on the safety bicycle. Some others were, however, including an experimental model designed in 1897 by Arthur Herschmann, chief draughtsman at Dunlop.³⁰

The Werners, however, did two things which nobody else did: they patented the idea, and turned it into a successful motor cycle. They successfully defended their patent in court when Gamages offered a machine manufactured for them overseas which had the engine placed in exactly the same position, and attached to the frame in exactly the same way.³¹ But it was quite easy to get round the patent by attaching the engine slightly differently, and most manufacturers did so with little difficulty either by looping the frame round the crankcase, by constructing a cradle to hold the engine, or by using the crankcase to form a part of the frame. The result was to preserve the main principle and the advantages of the new Werner without contravening the patent.

The Minerva and the new Werner set the general pattern of development of the motor bicycle in these years, but they come far short of providing a complete picture. Before the Werner was widely adopted and even when the popularity of the Minerva was at its height, there were a great many different types of motor bicycle design, the

main distinguishing feature of which was always the engine placing. Some of these are illustrated in fig. 8.6. Of the twelve designs shown, only one, apart from the Werner, survived for regular motor cycle use. This was the Humber.

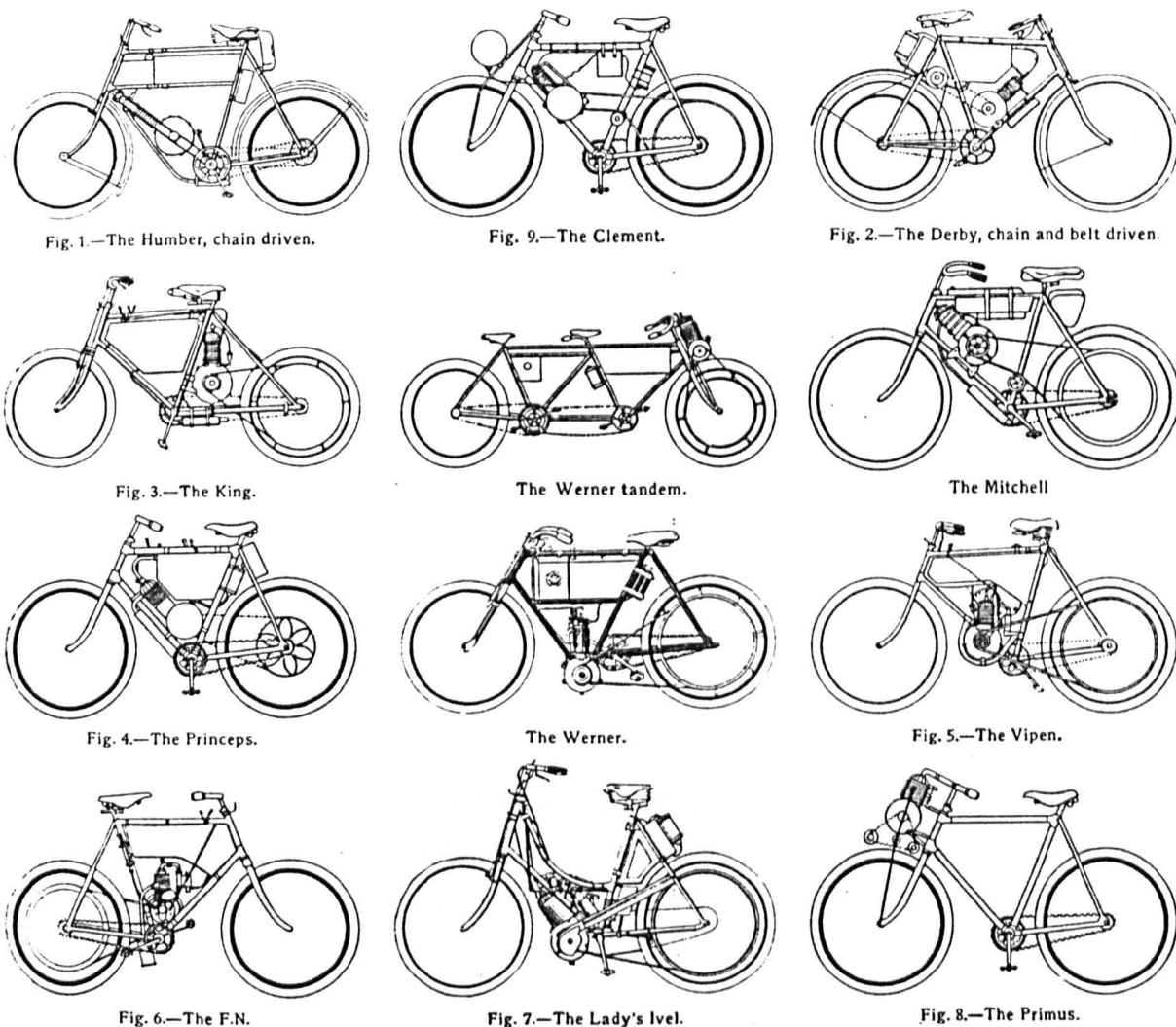


Fig. 8.6. Some Motor Cycles at the Crystal Palace Show
("The Autocar", 22 February 1902)

The Humber motor bicycle illustrated was designed by Joah Phelon in 1900. Lacking the resources to manufacture the machine himself, Phelon looked for a firm which might do so. Eventually Humber agreed, but rather than buy the patent rights, they preferred to manufacture it under license for a fee of 7s.6d. per machine.

Phelon, built the engine himself in 1899, while in

partnership in a small tool-making business with Harry Rayner, his brother-in-law. It was too high, however, to fit vertically into the largest available cycle frame, so he removed the front down-tube and put the engine in its place so as to serve as part of the frame.³² As in the case of the new Werner, the idea was not original, but Phelon and Rayner were the first to patent it. It turned out to be a sound design which eventually became popular, but, meanwhile, progress was slow. The arrangement with Humber left Phelon and Rayner free to manufacture the machine themselves, but only six were produced in the first year. In 1904 Rayner was killed in an accident and Phelon went into partnership with Richard Moore, a young engineer.³³ The machine became known as the P & M, and Moore, who was a motorcycling enthusiast, rode it successfully in reliability trials.

The Humber version did quite well for several years, but was eventually dropped, and from then on it was left to Phelon and Moore alone to continue development of their design.

As there were no imitators of the P & M at that time, the new Werner pattern was by 1903 the effective standard at least as far as engine placing was concerned. There were many other problems of design, however, which would not be solved so soon.

The Pace of Development

In 1901 motor bicycle frames were still almost identical to the standard bicycle frame. But good as it was for cycling this was too high and uncomfortable for the powered vehicle and it would take five or six years more before more suitable frames were developed. Transmission systems were a matter for continuing controversy which did not end with the widespread adoption of belt drive. Free-engine devices or clutches and two-speed gears were practically unknown.

Carburettors could be either of the surface type as in the Minerva, or the more advanced spray type, neither of

which was new. By 1903, however, the spray carburettor, like the new Werner pattern, had become almost universal. The long-standing controversy of hot-tube versus electric ignition (see last chapter) having now been settled, the issue became magneto versus trembler coil. The latter meant carrying batteries which had to be recharged after every two hundred miles or so but was easier to put right when faults developed.³⁴ The magneto was fundamentally more efficient and so was bound to win in the end, but not for several years. Engine lubrication meant for most machines that the rider had to stop every fifteen or twenty miles dismount in order to inject some oil into the crankcase. Automatic oiling was still a long way off for the ordinary machine, but a partial solution came as early as 1901 in the form of a manually-operated oil pump pioneered on the Phoenix which enabled the rider to carry out this chore without dismounting.

Engines were still very much of the same type as that first developed by Daimler in the 1880s and subsequently adopted and popularised by de Dion-Bouton, and as such were air-cooled with four-stroke operation and automatic inlet valves. Superior alternatives were soon to appear but there would be years of controversy before any of them was generally accepted.

Thus at this time many areas of motor cycle technology were in a state of flux or soon would be. Yet there were already some definite pointers towards the standard machine that would have emerged by 1908. From 1897 onwards the motor bicycle frame had been standardized on the safety bicycle format. At the same time belt transmission was developed and soon became standard, remaining so for the majority of machines for the next twenty years. With the development and widespread imitation of the new Werner, the motor bicycle began to look not very different from the machines of the future. But there was still much to be done and important developments now came almost every year.

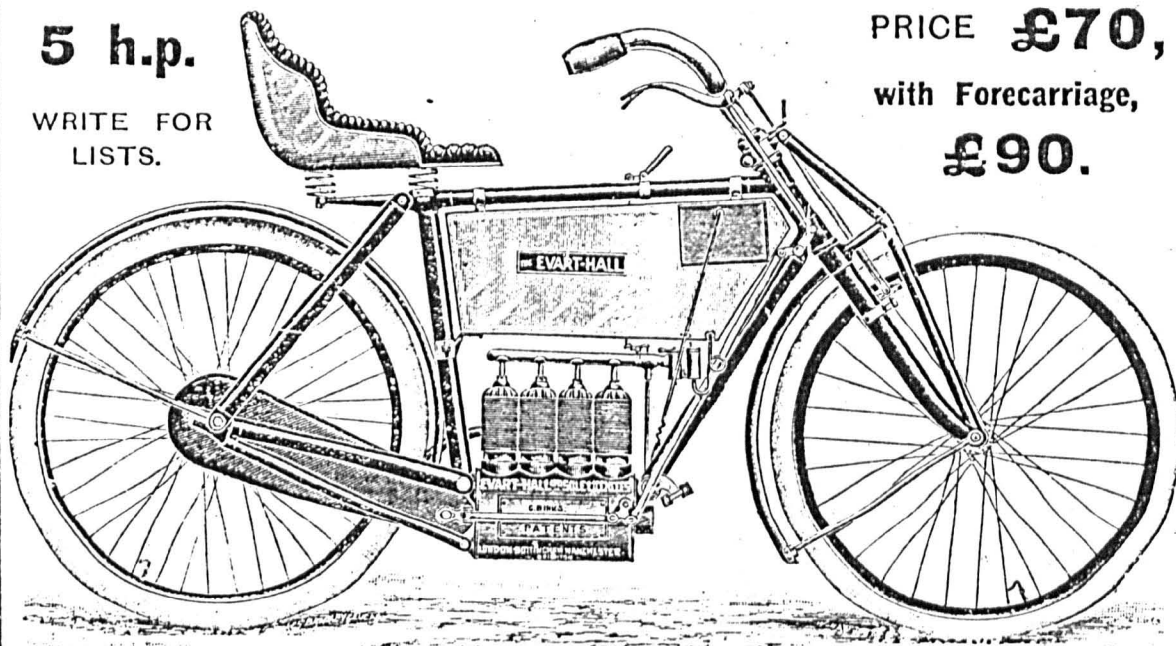
1902 saw the introduction for motor bicycles of mechanically operated inlet valves (mov), V-twin engines, and

C. BINKS'S PATENT FOUR-CYLINDER MOTOR CYCLE, OR TWO-WHEELED CAR.

5 h.p.

WRITE FOR
LISTS.

PRICE **£70,**
with Forecarriage,
£90.



Is there a single improvement suggested in "Correspondence"
that is not embodied in this wonderful machine?

READ:

- | | |
|--|---|
| 1 A four-cylindred motor, giving two impulses each revolution. | 16 Chain runs in oil bath case. |
| 2 No shock or jar at starting, or any time. | 17 No gymnastic performance in mounting. |
| 3 Free engine. | 18 Can be mounted by a cripple. |
| 4 A perfectly gradual all-metal clutch | 19 Cannot overheat. |
| 5 That can be allowed to slip to any extent | 20 Large outside flywheel. |
| 6 Without injury to it. | 21 Enormous brake power—band and rim. |
| 7 All enclosed in an oil bath case. | 22 Luxurious "Roi de Belge" seat. |
| 8 Plenty of power to take you anywhere. | 23 2½ in. Dunlop tyres. |
| 9 Engine started with one turn of handle. | 24 No festoons of wires or arrays of levers. |
| 10 Control—hands never off bar. | 25 None of the endless worries of the ordinary motor cycle. |
| 11 Great freedom from side-slip. | 26 Ball bearings to engine. |
| 12 Feet always within touching distance of ground. | 27 Strictly first-class workmanship. |
| 13 Will run dead slow. | 28 The only machine for a forecarriage |
| 14 Capable of immense speed. | |

Rides like a £1,000 Car. & No Noise or Vibration.

ON VIEW, **STAND 5,** CORRIDOR, CRYSTAL PALACE SHOW.

THIS MACHINE REALLY DOES FULFIL ALL THE ABOVE—

CAN YOU BE CONTENT WITH THOSE THAT DON'T?

Charles Binks, Limited, Whitehall Factory, **Nottingham.**

Fig. 8.7. The Binks "Four"

("The Motor Cycle", 16 February 1906)

water-cooling. The Phoenix of that year was one of the first machines to be fitted with a two-speed gear. Of these developments, the motor and the V-twin engine soon began to achieve a degree of popularity, but water-cooling was almost completely abandoned within two or three years. The two-speed gear, despite frequent calls for such equipment, was very slow to achieve any following.

In 1903 Charles Binks introduced his four-cylinder motor bicycle (fig. 8.7), one of the first of its kind. But perhaps because of its weight and its initial unreliability, and almost certainly because of its price, £70, it failed commercially. In contrast, a similar machine of lighter weight and lower price (fig. 8.8) that was introduced by the Belgian firm, FN, the following year, did quite well.

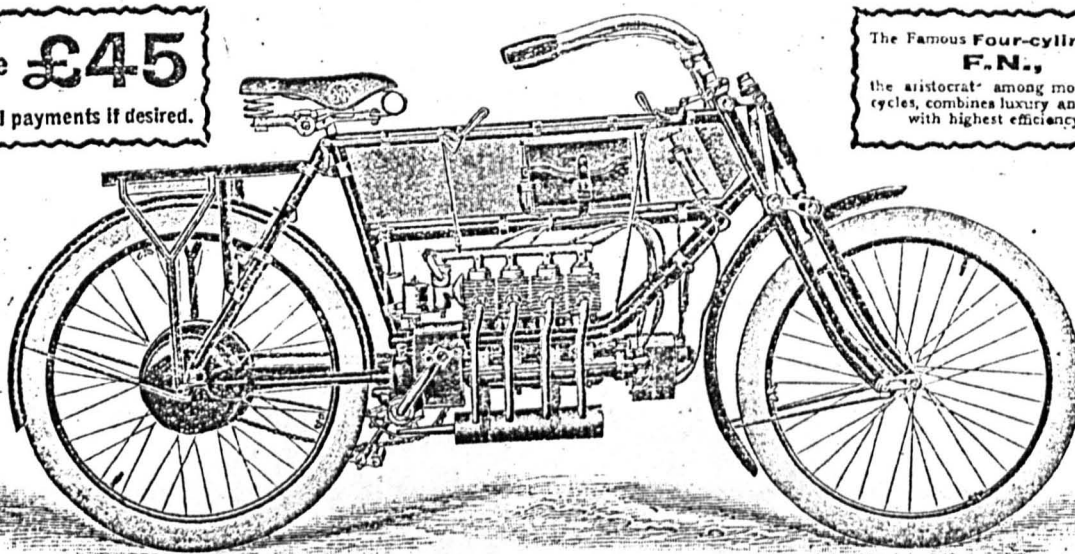
Anybody who has ridden the

FOUR-CYLINDER F.N. FOUR-CYLINDER

would never want to go back again to a single or twin-cylinder machine.

Price £45

Gradual payments if desired.



The Famous Four-cylinder
F.N.,
the aristocrat among motor bicycles, combines luxury and ease with highest efficiency.

To ensure early delivery, orders should be placed at once with

The F.N. MOTOR AGENCY. Temporary Address: 139, QUEEN VICTORIA STREET, LONDON, E.C.

Fig. 8.8 The Belgian F.N. "Four"
("The Motor Cycle", 29 January 1906)

However, the vast majority of motor bicycles still had single-cylinder engines. Almost 80% relied on belt drive, and 90% on coil ignition charged by a battery. This meant that desirable improvements like chain drive and magneto ignition lagged, but moves were making better progress since by the end of 1903, only a year since their first introduction, 30% of machines were already equipped with them.³⁵

1904 saw the first all-Triumph motor bicycle. It was driven by an engine of Triumph design equipped with ball bearings: the first successful application of ball bearings to the mainshaft in a motor bicycle engine.³⁶ This was the first major indication of the role that Triumph would play later in the development of better machines.

The following year, 1905, saw the beginning of the slump in the industry and the fading away of many firms. But others still continued to do well, with Triumph and Quadrant reported to be "in the happy position of producing a machine that was already a proved success, and which in fact, could not be turned out fast enough to meet the demand for it".³⁷

Not every firm, however, was content to concentrate solely on the developing standard. Of rather more original design were motor bicycles developed by Phoenix (fig. 8.9),

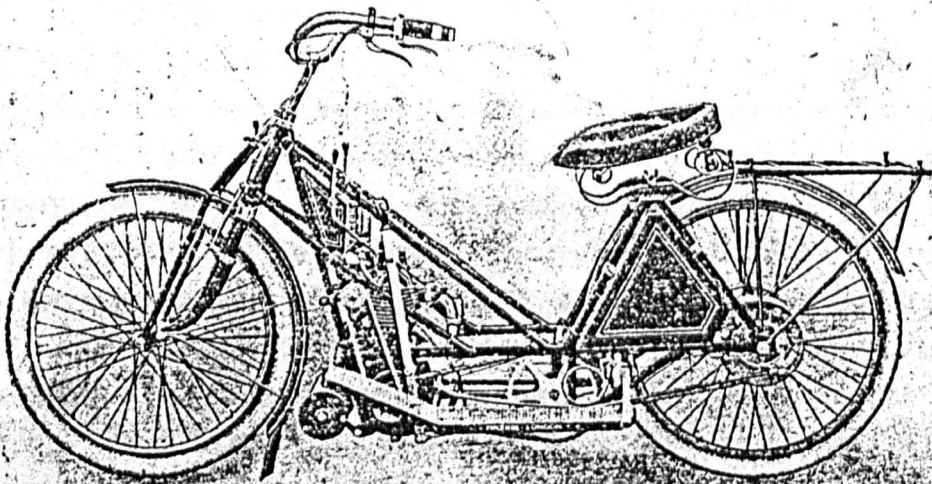


Fig. 8.9. The Phoenix Cob
("The Cycle Trader", 17 November 1905)

Zenith (fig. 8.10), and Brown, representing a type of machine which became known as the "bicar" (suggesting, perhaps rather too optimistically, a two-wheeled car). Characteristically, such machines had frames of entirely new design, footboards rather than footrests, and were usually equipped with car-type starting handles so as to do away with pedals. The Brown bicar was particularly original in construction. The frame was made of sheet steel instead of tubes, suggesting the pressed steel frames of more recent times.

It smiles at hills
and skims lightly
over the roughest
roads.

Not only the rider,
but also the engine,
carburetter, and all
other machinery are
insulated from vibration,
and cannot be jolted to
pieces over rough roads.
This adds many years of
life to the machines,
which are built to last

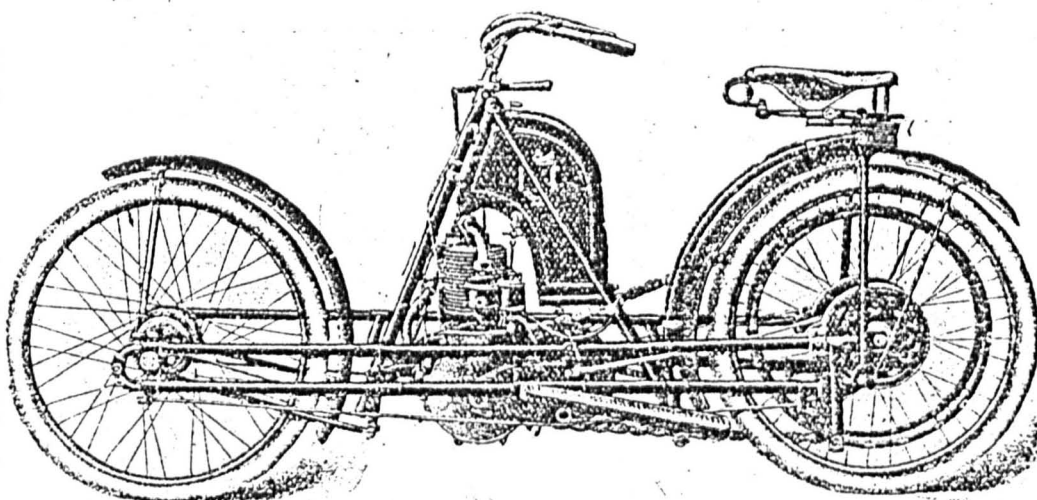


Fig. 8.10. Part of Advertisement for the Zenith "Bicar"
("The Motor Cycle", 5 December 1906)

These new designs were often highly praised, but not always—"neither did some of the weird shapes of cob and car bicycle tempt me"³⁸—and as it turned out, the latter view prevailed and few people were tempted. The bicar type was soon set aside although the scooters which came much later were not unlike it. Clearly by now the trend was already set against radical innovation and towards the standard machine: "I predict the motor cycle will be substantially unaltered at the 1906 show in November. Models are becoming standardised, and probably fewer will be exhibited. Those exhibited will display the perfection of present tendencies rather than the introduction of

entirely new principles".³⁹

The above comment was borne out—admittedly by the same writer—in a review of motor bicycles at the shows the following year: "The Quadrant is practically the same machine as last year.....The Triumph catches the eye as being very similar to the 1906 pattern ostensibly, but in reality a vast amount of quiet improvement is hidden in it.....In the 3½hp Brown I failed to find any alteration or, the need of any, and the Vindecs are similarly content to rest on an old reputation".⁴⁰

Thus BHD was able to conclude: "In summing up, it may be said that motor-cycle design as a whole, has already arrived at a permanence of essentials, including low frames, magneto ignition, belt drive, vertical engine in front of the bottom bracket, and a minimum of 3½hp, with as much more as faddist riders choose to ask for".⁴¹

That the motor bicycle was at last settling down to a standard form probably owed more than anything else to its development into a reasonably satisfactory machine—a machine that would both satisfy the experienced motorcyclist and appeal also to the prospective newcomer to motorcycling.

With the development of a standard machine now close to realization, it was at last reasonable for firms to start thinking about standardization in the interests of larger scale production, and this despite the slump in the industry. Rex, probably still the largest motor cycle manufacturer, put this point in a letter to "The Motor Cycle": "the motor bicycle has followed the evolution of other mechanical commodities, as e.g., the gas engine, the bicycle, the typewriter or the sewing machine, in the sense that scientific standardisation in quantities by specialists has reduced the percentage of establishment charges and automatically brought about a cheapened cost. A properly organised factory with up to date appliances devoted exclusively to one kind of machine is capable of turning out sixty complete machines as easily as were six on the previous antiquated method before present day

standardisation became possible."⁴²

But with output for the industry as a whole still rather low—in fact a good deal lower than it had been a year or two previously—the majority of firms remained small and probably still produced their machines by "the previous antiquated method" that Rex had referred to.

The temporary decline in the industry and the tendency for major firms to concentrate on minor improvements to their machines, did not prevent some firms introducing more significant improvements. Probably the most important development observed at the 1906 shows was the substantial increase in the number of machines equipped with variable gears, twelve altogether, when in the previous year there had only been two or three. Even so this was not very much when compared with the total number of machines exhibited, more than one hundred and fifty. In some other respects, however, there was rather more progress towards standardization across the industry as a whole. An analysis of 167 machines listed in "The Motor Cycle Buyers' Guide" for 1906 shows that 152 had belt transmission, 164 were air-cooled, and 114 had some kind of springing. The mechanically operated valve was now almost as popular as the automatic valve and would soon surpass it.⁴³

In 1907 the trends of previous years intensified. Most machines now had some kind of variable speed gear although usually of a very primitive kind in the form of an adjustable pulley in the transmission system. This meant that in order to change gear it was necessary to stop and dismount, an inconvenient system but far better than having no choice at all. Magneto ignition was now in the majority, footrests were becoming more popular and frames were "lower than ever".⁴⁴ Spring front forks were by now so widely adopted as to be virtually standard equipment, but spring frames remained rare mainly because of the difficulty of developing an effective system.

Among the more interesting designs of the year was a Douglas machine equipped with a V-four engine, and the Max, a scooter-like machine intended as a "runabout". These

were interesting ideas for the future, but were probably ahead of their time and neither remained in production for long.

Of much greater importance was a new trend towards lightweight machines. The increase in weight of the typical motor bicycle was an inevitable result of technical sophistication and more powerful engines. Riders had complained about the weight of machines even from the earliest days of motorcycling, but until now little had been done to meet their complaints. In 1904 most of the few lightweight machines on offer had been dismissed by one commentator as little better than toys,⁴⁵ but at last manufacturers were beginning to respond and many new lightweights of reasonable performance were coming onto the market.

"The Motor Cycle", recognising this development, suggested there were now three categories of machine: lightweight from 75 to 100lbs, middleweight from 100 to 150lbs, and heavyweight from 150 to 200lbs.⁴⁶ This was possibly the first occasion on which the development of the motor bicycle into distinct categories was recognised. Eventually it would mean not just one, but three different types of standard machine. Meanwhile, the standard machine was typified by the Triumph—a middleweight with a single cylinder engine, belt drive, magneto ignition, spring forks and rigid frame.

This was the kind of design which every firm would want to imitate so long as it was more concerned with establishing itself in the industry and making money than with developing something new and untried which, however good it might be, would very likely be rejected by the consumer. Nevertheless, as will be seen in the next chapter, a number of firms still preferred to set out on the latter path rather than the former.

In the following section the rise of Triumph is discussed in detail in comparison with the rather different approach to product development of van Hooydonk, the manufacturer of the Phoenix machines.

Approaches to Product Development: Phoenix and Triumph

Phoenix. Phoenix was the marque name for the firm of J.van Hooydonk. van Hooydonk began cycling in 1886 and competed in many races setting a number of records. By 1889, at the age of twenty-two, he had established himself as a small cycle manufacturer.⁴⁷

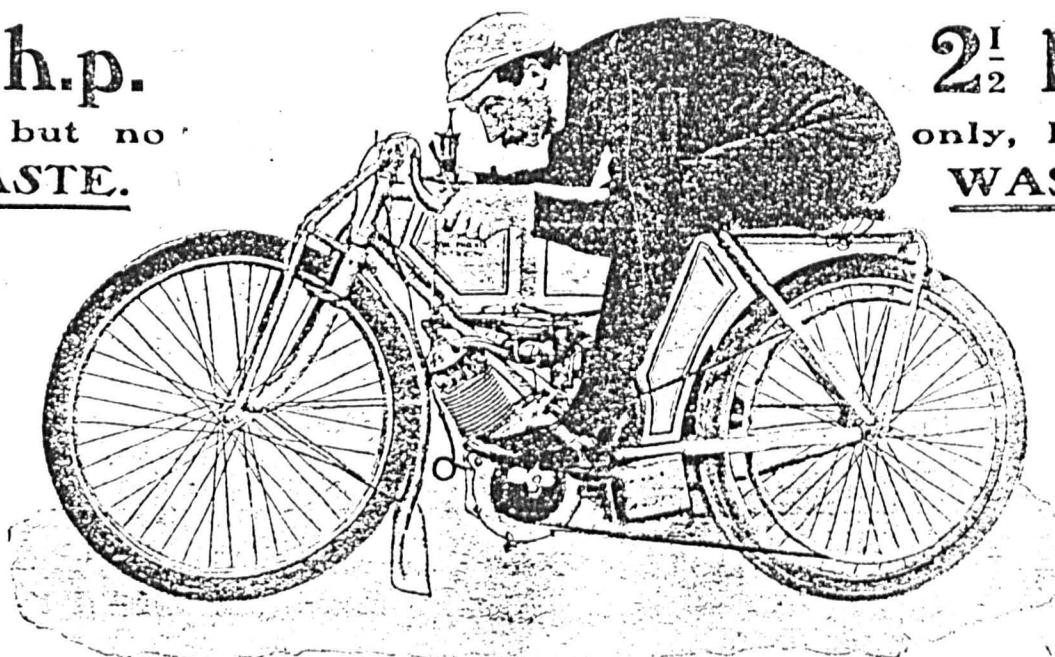
He took up motor cycling because, in his own words, he "Liked to move with the times and had an idea there was scope for improvement".⁴⁸ After riding his first machine, he decided that several improvements were desirable: "Stopping every fifteen miles to oil up did not agree with a man who would some time run to Peterboro' without dismounting. Result: Oil pump. Second ride, ran out of petrol thirty miles from home, 12p.m. Result: Spare tank of registered design as fitted to all Phoenix machines".⁴⁹

Both of these developments were incorporated in the first Phoenix motor bicycle placed on the market early in 1901. The machine was basically of Minerva pattern with a 1½hp Minerva engine. The spare petrol tank was situated between the saddle tube and the back wheel. The result was a rather heavy machine for those days. It was highly praised, however, by A.J. Wilson who thought it "the most advanced standard pattern motor bicycle on the market",⁵⁰ and had one made to his own particular requirements. Further improvements followed including the addition of a cycle-type two-speed gear,⁵¹ the machine's most important distinction. Later on, alternative engine sizes were offered including a 2½hp model (fig. 8.11).

The performance of the Phoenix motor bicycle was as impressive as its specifications. In one of his first attempts to use it for record-breaking, van Hooydonk set out to ride from Land's End to John-o'-Groat's, but was defeated by the weather after covering 357 miles in a day and half.⁵² The Phoenix did well also in competitions. One of its best performances was first place in the one-hour race at Crystal Palace in August 1902 when van Hooydonk covered more than 42 miles in the hour, winning by more than three miles from many well-known riders.⁵³

2 $\frac{1}{2}$ h.p.
only, but no
WASTE.

Every
ounce
helps
to
drive
the
machine.



2 $\frac{1}{2}$ h.p.
only, but no
WASTE.

Every
ounce
helps
to
drive
the
machine.

OUT FOR SPEED. Registered No. 376493.
42 $\frac{1}{4}$ Miles in 1 Hour (RECORD).

Fig. 8.11. J. van Hooydonk on his "Phoenix"
("Motor Cycling", 21 January 1903)

Following his success with the two-wheeler, van Hooydonk turned to three wheels. The idea came to him after an unhappy time trying to get out of London on two wheels "with many cars round me and slippery tram-lines to cross".⁵⁴ In response he "rigged up a rough contrivance, it went well, and open space in front appeared to ask to have a seat put on it, rigged up an old trailer body, and there was the Trimo!"⁵⁵

The Trimo, a tricar-type machine, was first marketed in 1903. It was a popular success, so much so that it was widely imitated and the name "Trimo" became the generic term for this kind of machine, whoever the manufacturer.

Meanwhile, the Phoenix motor bicycle remained in production in much its original form while other manufacturers were turning from the Minerva pattern to the new Werner. The Phoenix was almost certainly one of the last Minerva pattern machines to remain on the market, saleable perhaps and still worth manufacturing, because it was one of the

rare machines with a two-speed gear. Also, as the firm had remained small, a moderate output was still worthwhile.

But in 1905 a new machine was put on the market, the Phoenix Cob.⁵⁶ In describing the new machine, a commentator in "The Cycle and Motor Trader" first drew attention to some criticism of the original Phoenix motor bicycle: "Items coming under this head are such as excessive weight (chiefly due to the carrying of heavy high powered engines), difficulty of mounting and dismounting, general unweildiness due to weight and aggravated by height of rider's weight from ground, the two in combination and in turn being the prime factors in causing side-slip".⁵⁷ By now the machine was almost five years old and, although still of good performance, had been left behind somewhat by developments elsewhere, particularly in terms of lower frames and longer wheelbase which made machines more stable and easier to ride. Thus a change was due.

If at this stage van Hooydonk had developed a machine similar to the developing standard—that is, rather like the Triumph—and improved it with some of his own ideas, he may well have created a best-seller. This was not to be. The Phoenix Cob was designed to correct the deficiencies of the older machine, but it was too original in concept to gain easy acceptance from the general public.

The new frame was of original design, fully triangulated and open in construction so as to make the machine equally suitable for ladies (fig. 8.9). The standard engine was a 2hp Minerva, although a 2½hp model was available. It was fitted with a spring clutch and two-speed gear, and transmission was by two chains and countershaft. It was started by a car-type handle and, in place of pedals or footrests, it was fitted with footboards.

In summing up his report, the writer concluded: "Assuming all other things to be equal, we think the points which will appeal most especially to the class of rider the machine has been designed for are the starting of engine with machine stationary, the ease of mounting the low seat with both feet on the ground before throwing the clutch in,

and the roomy footboards with facility for easy dismounting".⁵⁸

The Phoenix Cob was well made, of advanced design and good performance. Its fault from a commercial point of view was that it was aimed at a minority rather than a mass market. It remained in production for two or three years only.

According to BHD, production of all Phoenix motor bicycles was brought to an end because of the slump in the industry.⁵⁹ Against this we may judge that the Cob was an unconventional machine of a type which was not always well received, and it differed considerably from the developing standard in appearance, frame design, means of starting, and chain drive. Did it really fail therefore, because of the slump or because consumers would not adopt such an untypical machine? The latter conclusion is almost certainly the correct one since Triumph and some other manufacturers of more standard machines survived the slump quite well. van Hooydonk left the motor cycle industry at the end of 1907 to concentrate on cars and his firm survived until the 1920s.

Triumph. Triumph was founded by Siegfried Bettmann, a young German who came to this country in 1884. In 1885 he started an import-export business in London, exporting Birmingham made bicycles under a "Bettmann" label. He changed this to "Triumph" in 1886, a name he considered would be more easily understood by his customers. In 1887 he was joined by another young German, Mauritz Schulte, who was an engineer, and the following year they moved from London to Coventry where they set up a small cycle manufacturing business.⁶⁰

Triumph machines soon became known for quality and were very well thought of in the trade, but the firm remained small until it came to the notice of Harvey du Cros, the founder of the Dunlop Tyre Company, who decided to invest some of his spare capital in it. As a result the company grew rapidly and by the late 1890s it was making a profit of about £7,000 a year,⁶¹ which put it

among the largest cycle manufacturers.

Entry to the motor cycle industry had first been considered in 1896 when Schulte tried out one of the H & W machines with a view to manufacturing it, but he decided against the idea. In 1901 the company considered taking over the failing New Beeston Company, but decided instead to begin motor cycle manufacture more directly by producing a Minerva pattern machine.

The machine, first produced in 1902, was well made but rather conventional in that it deviated little from the standard Minerva. It sold well,⁶² but was replaced in 1903 by a design based on the new Werner pattern and powered by a British made JAP engine. The most important step forward, however, did not come until the following year when the firm developed its own engine so as to produce the first all-Triumph machine. The engine was the "ball-bearing" engine already mentioned above (p. 159).

Triumph's performance so far had been solid rather than spectacular. They followed the trend in developing a Minerva pattern machine in 1902, a new Werner type in 1903, and an all-Triumph design, though still of conventional appearance, late in 1904 for production the following year. The new model was innovative but not in any way which deviated significantly from popular taste. Modifications were carried out within the basic format of the emerging standard and were calculated to improve the performance and convenience of the machine in general rather than to offer something radically new. It is easy to understand, therefore, why it was from about this time that Triumph motor bicycles began to acquire a reputation for quality and reliability.

But there was still much to be done and only now was the most important stage of developing the Triumph machine begun. The new engine, despite its improved design was as yet far from satisfactory. BHD described the Triumph of this time as "Delightful when new, it rapidly weakened down to the power of a cat and a half",⁶³ and it was BHD himself who did most to demonstrate the machine's weaknesses.

The guiding influence on the firm's design and engineering activities was Mauritz Schulte. In 1905 he asked BHD to suggest a publicity stunt to demonstrate the Triumph's merits. The result was that BHD agreed to set out on a ride of 200 miles a day for six consecutive days. So as to add authenticity to the undertaking, an official timekeeper was engaged.⁶⁴

The machine used, a standard Triumph model of 3hp, had magneto ignition, and was single geared with belt drive and no clutch. Its maximum speed was 45-50mph.

There have been two different reports of this event. In the first one, published in "The Motor Cycle" at the time, no breakdowns were reported except for four stops, one for a puncture and three resulting from broken piston rings.⁶⁵ But in his book, published much later, BHD tells a different story. Apparently things went moderately well until the end of the fifth day when the frame broke. But this was not all: "Moreover, the engine power had been steadily fading throughout the 1,000 miles already covered, and hasty examinations proved that the piston rings and cylinder bore had both worn unconscionably fast, while the exhaust valves were pitting almost to the scaling point".⁶⁶ It appears that the frame was non-standard, possibly an experimental model, so Schulte provided a second machine with a standard frame and the entire six day performance was repeated again the following week, this time with success. There was no point in bad publicity.

Whatever these six runs may have achieved in making the Triumph better known to the public, they were more important in underlining the need for more development work on the engine. The main problem was the softness and generally poor quality of the metal, which was, however, the best available at the time. It was Schulte himself who instituted the research to develop tougher steels, and by 1907 the problem had been solved.⁶⁷ The 3½hp Triumph of 1907 and later years (fig. 8.12) was, as BHD puts it, "reliable as Big Ben";⁶⁸ it won the Isle of Mann TT race in 1908 and set new records for the John-o'-Groat's-Land's

End run in 1909 and 1911. It was probably "the first completely satisfactory machine of its type in the world".⁶⁹

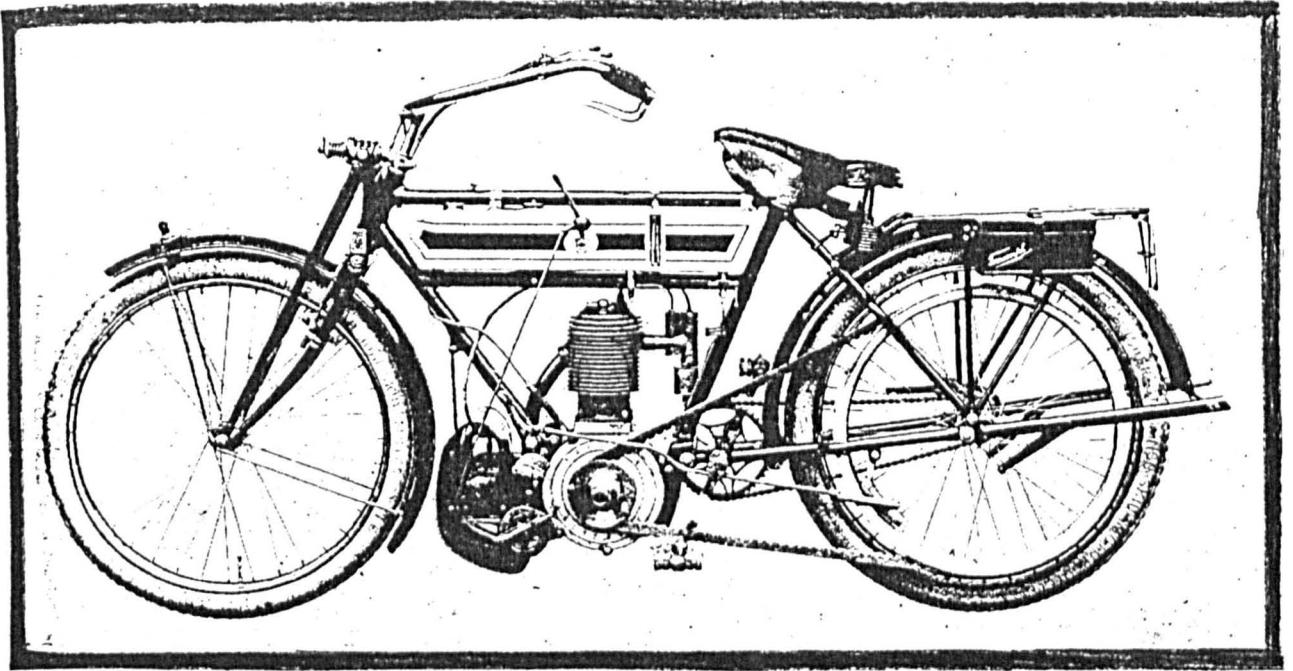


Fig. 8.12. The Triumph
("The Motor Cycle", 8 November 1909)

The success of Triumph machines was now assured. In 1907 production reached 1,000 machines a year for the first time. By 1909 this had risen to 3,000⁷⁰ and Triumph was the largest motor bicycle manufacturer in the country. The rise in profits was equally spectacular. In the years 1905-6 and 1906-7, when many other firms were suffering from the slump, profits were £13,428 and £14,313 respectively. The following year, 1907-8, they jumped to £22,048, and by 1911-12 they had reached £68,500.⁷¹ As "The Economist" observed: "The firm has stuck to their one model with few alterations, and the reputation which it has built up while rivals were struggling with imperfect machines, is really marvellous".⁷² It was no wonder that the Triumph became the standard which almost every other firm would want to emulate.

Comparisons and Conclusions

Both Phoenix and Triumph began in the 1880s as small firms with limited capital. Both graduated from the cycle industry to motor cycles. In both firms technical developments were initiated by one man who was either owner or a director of the firm, and both innovated significantly in one way or another; but here the similarity ends.

Triumph was relatively important in the early 1890s while Phoenix was still little known. Even so, had it not been for the substantial injection of Dunlop capital from Harvey du Cros, which was unexpected and unsolicited, Triumph might have remained a small firm for very much longer. Against this it seems that van Hooydonk had difficulty in obtaining capital to expand even when he had full order books which was often the case.

The greatest difference between the two firms was the style of their innovative efforts. Both began with a Minerva type machine, but the Phoenix was highly innovative while the Triumph was rather conventional. The innovations that van Hooydonk introduced were pragmatic and obvious, perhaps, to someone with much road experience and sufficient technical know-how to put them into practice. Against this, Schulte's most important innovations for Triumph were engine developments which could only have been thought of and carried out by a trained engineer. In contrast, van Hooydonk always relied on Minerva engines.

However, van Hooydonk had the ability and the inclination to create new concepts, the Trimo and the Cob, while Schulte concentrated on improving the standard model. It is tempting to say here that the more radically innovative output of Phoenix was a result of its being a small company not subject to the constraints of the larger firm, like Triumph, which expects to serve a mass market with more or less standard products. But this would be too simplistic a conclusion and probably not true. It seems more likely that these two men created their firms in their own images rather than being created by them.

van Hooydonk was a "personality", in fact one of the

best known personalities in the industry at that time. Apart from running his firm and taking part in reliability trials and other competitions, he was always writing letters to the motor cycling press or giving lectures on technical subjects. By comparison, Schulte seems to have been a relatively quiet man. But both without doubt sought to develop products which would appeal to the consumer, though van Hooydonk seems to have been more concerned with producing the kind of machine he would like to ride himself, than something which would appeal to the mass market.

Ultimately, Triumph succeeded by developing and constantly improving a machine which would appeal to the majority of consumers. van Hooydonk almost certainly failed as a result of developing a product which was too innovative and too different from the developing standard—too untypical of what consumers were coming to expect—to sell in sufficient quantities to keep the firm in the industry.

Personalities played a significant part in this outcome. Schulte was probably exactly the right kind of man for a firm like Triumph. van Hooydonk was the type of entrepreneur who sets up the kind of innovative firm which develops interesting products but never gets very big. Perhaps, if he had had more capital to expand, his firm might have grown substantially, but it seems doubtful that such growth would have been sustained at least as far as the motor cycle side of the business was concerned without some change in product policy.

The early success of Phoenix and the later success of Triumph, both owed much to the ability to look at the motor bicycle from the point of view of the rider. But this "user-orientation" was far from typical of manufacturers at the time as will be seen in the following discussion of the consumer's interest.

The Motor Cycle as Consumer Product

By 1907 the motor cycle had evolved from a machine which was dangerous, uncomfortable to ride and generally unsatisfactory, into one which, although far from perfect, could give riders a great deal in terms of performance, convenience and relative comfort and safety. We can get some idea of the progress made if we reconsider the hypothetical expectations that the prospective motor cyclist might have had of his machine (p. 120).

1. It should not be too complicated to understand and control.

Early motor cycles were bound to seem complicated to riders whose only previous experience was with unpowered machines, and efforts were made, as in the case of the Singer, discussed in the last chapter, to simplify controls. Such simplicity could not last. As machines were improved and performance raised, they would inevitably become more complicated. Electric ignition was far more difficult to understand and adjust than the old hot tube. Mechanically operated inlet valves could never match the simplicity of the automatic valve. The addition of a clutch and variable speed gears would add two more controls for the rider to think about. At the same time, however, riders did tend to learn more about their machines and to become more capable of handling them and performing simple repairs.

2. It should start easily and having been started it should keep going until the rider wants to stop.

At the beginning of the period, machines were still far from easy to start. Since most of them lacked a clutch, starting could only be achieved either by pushing the machine and then jumping on when the engine fired, or by pedalling. According to one memoir, this was impossible with the early Minerva because of the height of the saddle, 40 inches above the road.⁷³ The problem was eventually solved by providing a stand which raised the rear wheel off

the ground and enabled the rider to pedal while stationary until the engine fired.

Another of the problems in starting was the gummy engine oil which made it difficult to turn over the engine. The remedy was to inject some paraffin into the cylinder to dissolve the old oil, and most machines of the period were soon equipped with small paraffin containers.

Once started, machines were expected to keep going, but this was often not the case: "On many occasions my poor brother left home in the saddle; but never once did the Minerva bring him home again; always, it was he who brought it home with him, until I sometimes wondered why he bothered".⁷⁴

Nevertheless, the motor bicycle did gradually become more reliable and easier to start.

3. It should have reasonable performance on level ground, let us say, better than a pedal cycle, otherwise there would be no point in the extra expense, and it should go up hills (if possible!).

From 1901 onwards performance in terms of available power and attainable speed, improved rapidly. The Minerva could do only 35mph, but within a year or two there were machines which were capable of 50mph or better when the roads were good enough. By 1906 it was possible to buy machines rated at anything from 2 to 8hp (that is, with engine size of up to 1,000cc), so even without variable gears it was not difficult to find one capable of ascending almost any hill.

4. It should handle in traffic, that is, speeds should be variable and brakes should work.

Only one or two machines had variable gears before 1906, so driving at slow speed was difficult. A partial solution was to ride a machine with a multi-cylinder engine which would be much more flexible than a single cylinder. Twin and four cylinder machines began to appear from 1903 onwards, but they were never in the majority.

Brakes, especially in earlier days, were very poor, and on one occasion riding an early Werner, a rider, finding that his brakes did not work, "had to steer into a hedge and get smashed up somewhat, to avoid a watery grave".⁷⁵ But even by 1904 brakes were still so bad that one writer found it desirable to advise his readers how to stop when the brakes failed. The advice was to slip out of the saddle backwards and hold the machine up by the saddle thereby raising the rear wheel off the ground until the engine could be stopped.⁷⁶ Such comments could hardly have encouraged people to take up motorcycling.

The cycle type brakes of the earlier machines were, however, slowly giving way to better ones particularly for the rear wheel. Probably the best motor cycle brakes of the period were those which operated on the belt rim. Better still would have been the internal expanding brake already developed for cars but this was still some way off.

5. It should be reasonably stable and certainly no less so than unpowered machines.

The abandonment of the old Werner pattern and the fitting of engines low down between the wheels, greatly improved stability, but there remained much room for improvement. The riding position on the standard bicycle was high to allow ground clearance for the pedals. As engine power increased, the need to pedal became relatively infrequent and it was possible to reduce frame height even though the pedals were retained. Frames became longer and lower which made motor bicycles both easier and safer to ride (compare fig. 8.3 with fig. 8.12).

But even this was not enough and skids still occurred too often. Apart from bad roads, a major cause was smooth tyres. Manufacturers responded by developing non-skid tyres, but before the modern patterned tread appeared, various other ideas were tried including tyres with protruding metal studs, and chains which could be fitted to ordinary tyres.

6. It should not be too uncomfortable to ride.

The question of comfort on a motor bicycle is problematic. Even today any motor cyclist who rides for several hours with little or no rest is likely to finish up with some aches and pains. The problem is that with any motor bicycle the rider is almost permanently confined to a single riding position. Normally he has only one place to put his feet and that is on the footrests, or with the earliest machines, on the pedals. Footrests were an improvement over pedals and increased the rider's comfort. Footboards, introduced from about 1905, were better still since they were fairly long and did allow a variation of position.⁷⁷

To judge by some of the accounts which follow, comfort was never the major consideration of the enthusiast. As the market expanded, however, new recruits to motorcycling would have to come largely from people with little road experience,⁷⁸ and comfort would become of increasing importance.

The Rider's Response

As we have already seen, complaints about new technology are the rule rather than the exception. However advantageous new technology may be to the consumer, somebody, somewhere, will complain about it. There were complaints about hot tube ignition because of its dangers, and electric ignition because of its complication. Despite the advantages of mechanically operated valves, people still found cause to complain about them. The lack of variable gears was a frequent cause for complaint, yet when they were introduced some riders found them an unnecessary complication.

One aspect of motorcycling which riders were more likely to praise than complain about was its economy, but even here they were not always satisfied particularly when it came to the cost of repairs. There were many letters to the motorcycling press giving details of running costs over a given distance or period. Table 8.3 indicates the

50 gallons of petrol	2.16.10
Lubricating oil	10.10
Carbide	5. 8
Belts and fasteners	4. 8. 3
Licences	2. 0. 0
Tyres	3.14. 6
Repairs, replacements, etc.	10. 5. 7
 Total	 £24. 1. 8

Table 8.3. A Rider's Running Costs⁷⁹

breakdown of one rider's costs for 3,024 miles on a 5½hp twin—one of the heavier machines—over 3,024 miles: an average of 1.9d per mile.

But repair and maintenance costs were not always as high as these figures indicate, and a rider of a similar machine did rather better in covering 8,000 miles with running costs, excluding depreciation, of £32. 7. 3, 0.971d per mile.⁸⁰

The problem of repair was exacerbated somewhat by the fact that spare parts often did not fit very well and were not always truly interchangeable. Screws were sometimes too large or the screw holes too small, so that it required some filing to get parts to fit.⁸¹ One correspondent complained that after dismantling a broken-down engine he found that "bolts and nuts were not interchangeable, each bolt and nut having evidently been fitted as a separate and complete piece of work".⁸²

We may conclude then that maintenance was likely to be difficult and repair costs high for early motor bicycles, but, given the low price of petrol, overall running costs were usually low enough to represent one of the major attractions of motorcycling to the novice. Thus despite the various pitfalls, progress was being made, and as the following accounts indicate, the motor bicycle was a far better machine than it had been in the previous decade:

The Machine on the Road

The original Werner motor bicycle was discussed in the last chapter, but many people were still riding such machines in 1901 and to recall what they were like and what they could do, it would be of interest to refer briefly to Hubert Egerton's run from Land's End to John-o'-Groat's, the first time this had been achieved on a motor bicycle. According to Egerton's report, he maintained full speed most of the way despite hours of pouring rain and greasy roads. He experienced occasional rear wheel skids but no serious trouble and the run was completed in four days eight hours.⁸³ Thus although the early Werner was probably the most dangerous and unstable machine of all those to achieve any popularity, in the hands of an experienced rider it could be ridden safely and for long periods. Probably the most important achievement in following years was to bring such performance within reach of riders of no more than average competence.

The first rider to attempt to break Egerton's record was van Hooydonk on his Phoenix. The Phoenix was a much more advanced machine than the Werner, but van Hooydonk also had to contend with the weather. The first day's run went well, with 243 miles being covered, but on the second day the weather was wet and the road often slippery: "After Worcester, the surface of the road became clayey, and on reaching Kidderminster he had a bad slip, which meant a stop for repairs. The roads then got from bad to worse, rain fell in torrents, and the spill made him very careful".⁸⁴ He reached Warrington at 6pm but then "being wet, alone, and tired, he came to the conclusion that it was too late in the year to do good time over so long a distance, for the roads, being a good deal cross country, one required daylight to find the way, unless the ground had been previously covered".⁸⁵

Clearly motorcycling was still a rather hazardous activity. van Hooydonk was a highly experienced rider who would not have given up easily on a record attempt. But even without setting out to break records, most riders

would have encountered similar problems at that time. How quickly did things improve?

Both Egerton and van Hooydonk covered 200 miles or more on their first day. Two years later, BHD set out to cover a similar distance in one day, not as a record-breaking performance, but to demonstrate "the reliability of the modern motor bicycle to an interested novice".⁸⁶ His machine was an Excelsior (fig.8.13) and the route was a circuit of Devonshire, starting and ending at Barnstaple.

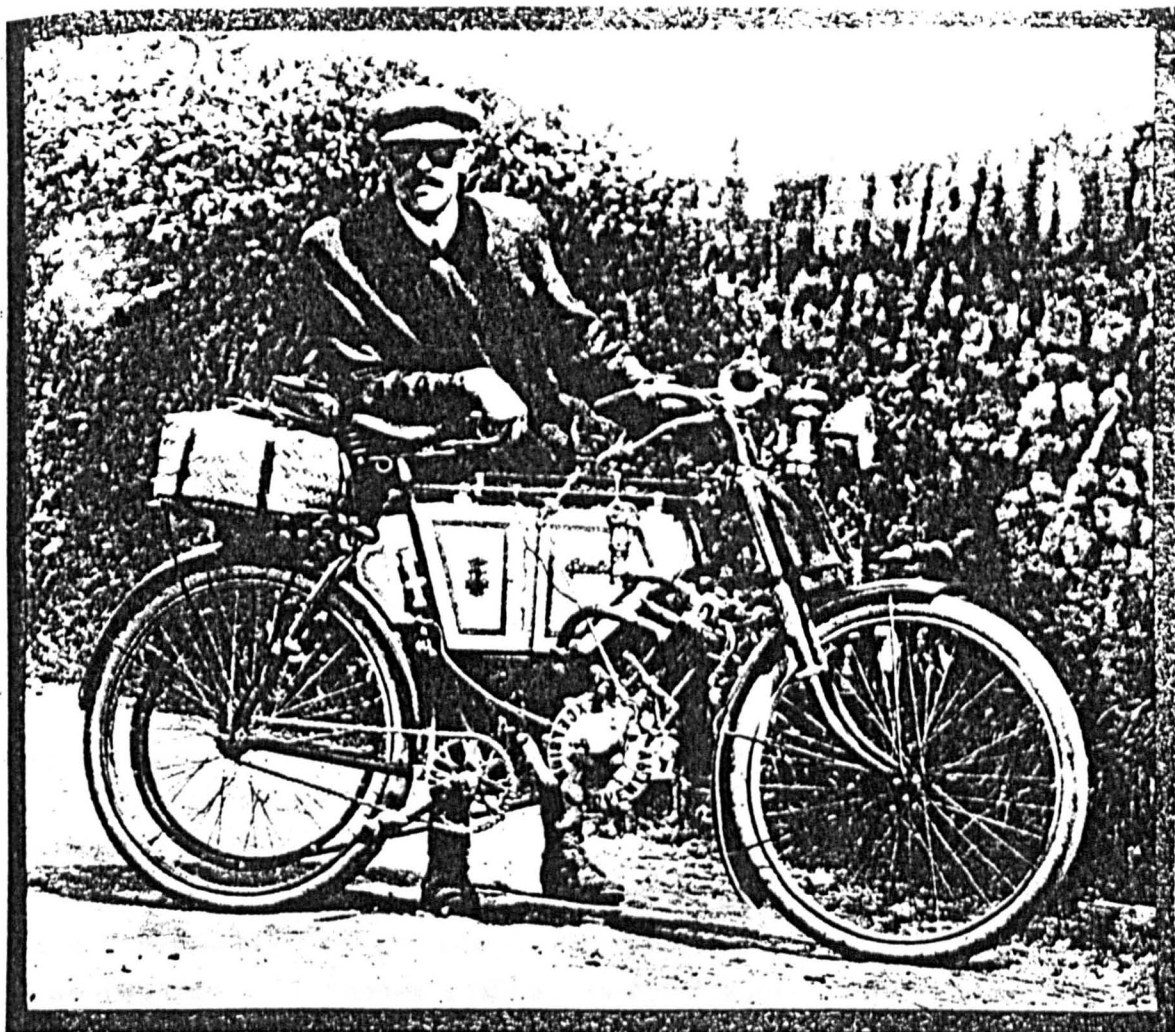


Fig. 8.13. "200 Miles In a Day": Mr B.H. Davies and his Excelsior 2 $\frac{3}{4}$ hp motor bicycle, loaded up with spare battery, two toolbags, and a valise containing two gallons of petrol, a spare lamp, and carbide.

("The Motor Cycle", 5 August 1903)

The run started at 7am and went well until the belt came off half-way up a hill. Before it could be put back, the fastener had to be retrieved from a bed of nettles: "Ten stung fingers are my reward for forgetting that there is a spare in my vest pocket. Then a fresh rush up the hill. Hills are the only place in Devon where it is safe to let a 2½hp 'rip,' and if the rider likes to take them fast, so does the M.M.C. engine".⁸⁷

Heading across Dartmoor for Tavistock, "The road is wide and deserted, surface splendid, and gradient downhill. Gradually the speed increases, till I am glued to the saddle by the rush of wind past me, and my cheeks are forced back against their bones, as if by the hand of some invisible giant. Surely we are touching '50"'.⁸⁸

Then disaster struck. One bar of the carrier gave way and luggage and spares were spread over the road a mile back over the moor. Nevertheless, some amateur repairs were carried out on the spot and the going was continued to Ivybridge for lunch: "So far, barring the one stoppage for the belt and the other for the carrier, I dismounted only at my own pleasure, and so it was for many a mile more, until at last impending doom began to fall. But of the engine and the electrical gear I have no word of blame".⁸⁹

The "doom" came in the form of the "inevitable dog" which dived under the front wheel and landed both machine and rider in a ditch, but neither was injured from the encounter.

Later, BHD met up with two friends, one on a bicycle, and travelled on in their company. It was now dark, but one by one all three lights failed and it was possible to continue only after obtaining a small paraffin lamp.

The final disaster came when the carrier, which was previously damaged, fouled the rear brake causing it to wrench "a score of spokes out of the rear wheel".⁹⁰ It was now 11pm and the end of the run for BHD who, having covered 185 miles, had to borrow a bicycle to complete the journey home.

Various conclusions can be drawn from this account. The Excelsior was a good motor bicycle. It was sound in basic function: the engine was powerful and reliable, and the frame did not break despite the exceptional load of BHD—no lightweight—and unusually heavy luggage. It was less satisfactory in other respects. The belt came off the pulley, the lamp failed, and the carrier broke. Few people at that time would have been so ambitious in their motor-cycling activities, but few would want to be until better equipment was available.

Motor bicycles were becoming more reliable but were often still far from well designed from the rider's point of view. An Indian army engineer who rode a Quadrant (fig. 8.14) found it could be remarkably difficult to oil the machine on the road: "one had to work the plunger, under and behind one's right leg, while leaning over to the right to see if oil was really being sucked into the glass cylinder of the pump with each stroke, and meanwhile to avoid Indians, bullock carts and dogs. The plunger had to be worked every 8 to 10 miles".⁹¹ In similar vein, a country doctor listed among his reasons for giving up

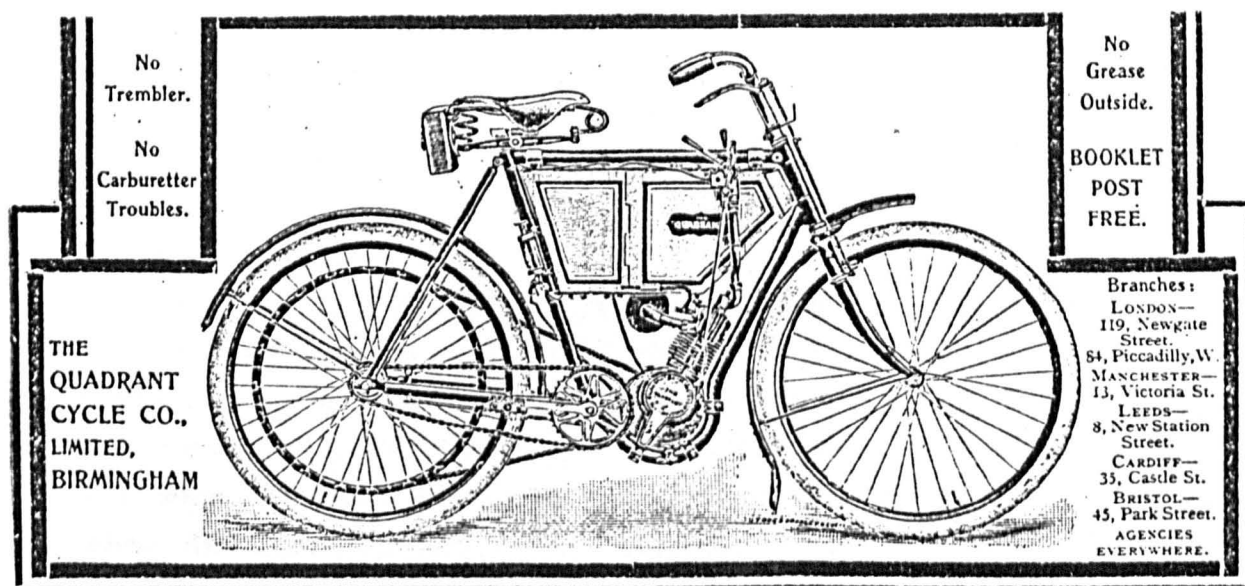


Fig. 8.14. Advertisement for the Quadrant
("The Motor Cycle", 31 March 1903)

Note the oil pump (like a syringe) directly under the seat.

motorcycling in 1903: "difficulty in starting, vibration and short circuiting in wet weather".⁹²

From 1903 to 1906 considerable progress was made in design, but was the motor bicycle yet quite the machine that someone would want to ride for business rather than pleasure, or was it still of interest mainly to adventurers, record breakers and publicity seekers? In 1906 an interesting assessment was published of "The Motor Cycle in Medical Practice by one who has tried it".⁹³

The writer's machine "cost me, including an acetylene lamp, spare accumulator, spare plug, valves, and contact wipe, and a large well-equipped toolbag, about £42. My only repairs have been for punctures, of which I have had three, whilst the cost of oil, petrol and charging accumulators, averages from 7s. to 10s. per month. I use the machine daily in all weathers, and with the exception of occasional stoppages at first, due to ignorance of the mechanism and how to adjust it, I have not had to spend a penny on repairs".⁹⁴

The disadvantages of motorcycling were listed as vibration, dirt, side-slip, and unreliability, while the main advantages were cheapness, convenience, lack of need for a chauffeur and the ability to go through narrow roads unsuitable for other vehicles. Most of the complaints against motor bicycles were dismissed as exaggerated which suggested that much still depended on the attitude of the motor cyclist.

A less optimistic view came from Mrs E. Kennard: "I have owned no fewer than five motor bicycles, but at the present moment I am bicycleless, much to my sorrow, simply because I cannot afford the expense of continuing to pay for experimental machines, which do not satisfy my ideals when delivered, and also because I do not know where to turn to procure the article I desire".⁹⁵

Mrs Kennard complained also about difficulties with maintenance—how many lady motorcyclists would do their own maintenance today?—"On one bicycle the accumulator case was made so small it took the best part of half an hour to

force the accumulators in or out; it was a mathematical puzzle to arrange them. On another in order to clean the chain three gear cases required first detaching, and one of them would not budge unless the left pedal and crank were removed. Would such a state of affairs be tolerated on a man's machine? On a third possession of mine the carburetter was practically ungetatable, and yet it required constant cleaning. On a fourth the contact breaker case was wedged in such a manner that it could not be undone. These are a few instances amongst many I could cite".⁹⁶

Control was another cause of difficulty: "My latest machine was fitted with no fewer than four levers, all placed in row beneath the steering column. To manipulate them entailed riding the whole time with one hand". But perhaps the most significant point was the last one: "Up to the present we have laboured under the disadvantages of our pioneer machines being made by men who did not ride them themselves, and who viewed them rather from their masculine standpoint than from ours. They thought they knew best, and disdained to listen to the complaints and suggestions of the practical female rider. And yet most of us know what we want, if only we could get it".⁹⁷ The point was well made, but it was not just women who suffered from this kind of attitude on the part of manufacturers, but consumers as a whole.

Motor cycle technology was advancing rapidly, but good design requires more than the application of new technology. It requires consideration of the consumer and the use he will expect to make of the product. Many manufacturers still failed to recognise this point and produced machines which could, with a little thought, have been very much better than they were.

The Developing Standard: Evaluation

The year 1901 marked the appearance of the first motor bicycles which had a potential for development which might eventually enable them to become recognisable, long-lasting standards for the entire motor cycle industry. The Minerva

was a major advance on earlier experimental models, but it was not quite good enough to become more than a rather transient standard when compared with the new Werner. (The Phelon-designed machine was also a potential standard, but it was more complicated in principal than the Werner and took rather longer to develop so that it never became a serious callenger to the Werner design for the majority market.)

The propositions of Chapter 4 are well supported by the evidence, as follows:

8. During this period there will be at least as many different product designs as at any other period of the industry's development, but the number will diminish rapidly as producers begin to imitate the more commercially successful ones.

The onset of the developmental phase of an industry's history does not mean that producers will abandon experiment on innovative design. But as potential standards emerge, new designs will tend to become less original and to converge towards the developing standard. Thus as we have seen they are for the most part no longer significantly different designs but more in the nature of developments of an existing standard. In 1900-1 in addition to many older designs like the Singer and the original Werner, there were many new ones including the Minerva, the new Werner, the Phelon and many variations on comparable themes, plus one or two that were entirely different. By 1907 the only machines significantly different from the new standard were those of the bicar type which were highly innovative. These helped to set a pattern which has almost always been maintained in that however highly standardized the products of the motor cycle industry, there have usually been one or two rather innovative, unusual, and, more often that not, short-lived designs which might appeal to the enthusiast but have rarely achieved a major share of the market.

9. Competition between potential standards will eventually leave one dominant design in each product class. This will become the developing standard and will be widely imitated.

The new Werner and the Phelon machine, although the first potential standards, were far from being the only ones during this period. The four cylinder Binks and FN machines and also the machines of the bicar type like the Phoenix Cob, were certainly potential standards in their basic soundness of design. The open-framed bicar was the precursor of the modern scooter and the Binks transverse four-cylinder model (not the machine illustrated) was the prototype of the Japanese "super-bikes" of the 1970s. But at the time none of these could compete with the basic single cylinder Werner type machine which soon became by far the most popular model.

10. Products which diverge considerably from the developing standard in terms of price, appearance, basic technology or performance, may enjoy short-run success but will eventually become difficult to sell.

The early Singer had sold for well over £60, and the Holden, for about £80, but from about 1901 onwards it required a very good motor bicycle to command a price of over £50 let alone £60 or more. Most machines were now costing between £30 and £50, and those which were much more expensive, like, for example, the Binks, could find few buyers. Price alone could account for the commercial failure of this machine. In comparison, the FN, a similar but more advanced machine, priced at less than £50, seems to have sold well.

It may be then that the new technology it offered was less of a deterrent to the consumer than price. On the other hand, the FN and other four cylinder machines, despite moderate popularity, particularly among enthusiasts, never seriously challenged the supremacy of the single cylinder. Neither did they really come to be viewed as reasonable alternatives to the more popular V-twin machine

for those activities where more power was needed. In effect fours was too far advanced to gain any great following at a time when for the majority of motor-cyclists, even the twin was unnecessarily complicated.

Appearance was clearly of major importance for the developing standard. With the widespread adoption of the new Werner type, most motor bicycles began to look rather similar. Thus the innovative bicar machines were at a handicap almost as soon as they appeared on the market and they did not do well. Possibly their open frame design suggested they were intended mainly as ladies' machines. This was not so, but, very likely, such a design was far from easy to sell to an Edwardian male.

The lack of reliable comparative data for most machines makes it rather difficult to judge just how far absolute performance such as maximum speed, for example, influenced the developing standard and resulted in the early rejection of untypical machines.

We can look at performance, however, in relation to technology since improved performance would be a major reason for rejecting old technology and replacing it with new. Automatically operated inlet valves eventually gave way entirely to mechanically operated ones because the latter were more efficient and gave better performance. But the transition was slow and took place in face of considerable scepticism from both uninformed and supposedly informed people alike. Thus out-of-date technology could sometimes survive much longer than might be expected although it would eventually be replaced. This suggests that few consumers would go out of their way to seek the ultimate in technology-based performance, but would be inclined to wait until the standard itself evolved in the new direction before committing themselves to it.

11. Products which deviate from developing standards may survive commercially if they offer the consumer compensation in nonstandard items.

Not many motor bicycles came into this category. Most

of the obviously nonstandard machines did not survive for more than two or three years. However, the original Phoenix design, although quickly outdated, lasted five or six years, rather longer than might have been expected, because it was one of the very few machines with a two-speed gear. The Phelon, although nonstandard in basic design, survived partly for the same reason but also because it was particularly strong in construction as a result of the design itself. Its quality and performance were demonstrated in competitions and it became one of the long-term survivors of the British motor cycle industry remaining in production until the 1960s.

The FN four-cylinder motor bicycle had a decided advantage when compared with more ordinary machines in the flexibility of its engine and the convenience and simplicity of maintenance of its shaft drive. It remained in production for about twenty years, a remarkable performance for a machine which was about fifty years ahead of its time.

Conclusions: The Development of an Industry

If profitability is any criterion, then the British motor cycle industry was barely in existence in 1901. At that time there was a fair number of firms making small numbers of motor cycles usually at a loss. In order to achieve long-term viability the industry required not more entrants per se, but more firms capable of producing better machines and selling them at a profit.

The large number of firms which entered the industry in 1901-3 was no guarantee that this would happen. Initially the reverse was the case. The majority of new entrants simply helped to swell the number of failures, their products were unsatisfactory, and most of them made a loss. As was argued at the time, too many firms entering too soon and producing inferior products, was no advantage to the industry.⁹⁸ It may indeed have been a setback as the poor products of many firms tended to give the motor bicycle a bad name,⁹⁹ and to send many would-be

motorcyclists elsewhere. Thus although production increased rapidly from 1901 to 1904, the apparent consolidation of the industry was illusory. From 1905 firms were leaving the industry faster than new ones were entering it and production was declining.

The industry was saved by a handful of firms, probably no more than half a dozen which, while observing the general trend of technical development, worked both to improve their products and to market them effectively. Of these the most notable was Triumph, but there others like Rex which supported their effort in producing good quality, competitive products. Thus although 1907 saw production lower than it had been for several years, the machines were now of much better quality and the surviving firms much better placed than previously to form the nucleus of an industry. The industry was at last all set for its real "take-off" and the end of the year marked a substantial increase in orders for motor bicycles. In the final analysis, therefore, it was a case of the survival of the fittest: if it had done nothing else, the large number of entrants had provided just a few firms capable of sustaining an industry which, as it turned, out was enough.

The survival and growth of these firms probably owed more than anything else to the kind of products they manufactured and their quality. In earlier days firms like Werner and Singer may have done well while turning out machines that were unlike the products of almost every other firm. This was no longer possible.

Since 1901 the motor bicycle had been evolving obviously and visibly towards a standard form based on the new Werner pattern. The transient and rather unsatisfactory early standards were being replaced though not always as quickly as might have been expected. The Minerva pattern which seems to have been adopted almost overnight by dozens of producers, was replaced within a year or two by the new Werner pattern. But the more enduring standard which the Triumph model of 1907 represented was not a rapid development but an evolution resulting from years of

smaller advances most of which were adopted only slowly by the bulk of the industry. The mechanically operated valve, one of the most important developments in engine technology, was introduced at the end of 1902 and quickly adopted by a few firms like Triumph, but not incorporated into some firms' products until eight or ten years later. The path of technical progress is often far from obvious, but it soon became essential for a firm to copy the developing standard in principle if not in every detail in order to achieve significant sales.

Thus the evolution of a standard product was a critical phase in the industry's history. Until some kind of standard existed, and a standard that would not be superseded within a year or two, there was simply no guide either to producers or consumers as to what would prove to be a worthwhile investment. Few producers could afford the financial risks of experimentation with untried technologies. Few consumers were willing to risk their cash and perhaps their lives testing unproven machines.

The rapid entries and exits of many firms in the early days of the industry was in large part a result of this lack of experience in the industry as a whole. The proliferation of different models may have been no more than bewildering to the prospective consumer, but it could have been ruinous to the firm which chose to manufacture the wrong design. It is almost certainly no coincidence therefore that the slump in the industry from 1905 to 1907 did not end until the motor bicycle had been developed not just into a stable and recognisable form but also into a reliable machine, a standard that promised much to both producers and consumers.

The new standard was less promising for more radical innovators. New products like the water-cooled engine, the four-cylinder engine, the V-four engine, the bicar and other scooter-like machines, and many smaller scale innovations, made only rather brief appearances on the motor-cycling scene at this time. For the most part such concepts were technically viable and potentially effective in

operation, but were ahead of their time either because of cost or because of the need for further development. But perhaps the most important factor in the rejection of new ideas was the high speed of technological development itself: many newer technologies were rejected simply because consumers had not yet had time to get used to the older ones. This was especially the case where new technology introduced added complication in a machine which was already being seen as too complicated.

In the 1890s, as we saw in the last chapter, consumers were quick to complain about the added complication of electric ignition as compared with the hot tube, and many preferred the latter despite its dangers. When the mechanically operated inlet valve was introduced there were efforts even from well informed commentators to prove that the simpler automatic valve was to be preferred. There was a similar response when the first variable speed gears were introduced with claims from a number of riders that the single speed machine was perfectly adequate to every purpose. The greatest added complication was the introduction of the multi-cylinder engine, and here there was a good case for rejecting the innovation since single cylinder machines were of quite sufficient power for most uses and particularly for newcomers to motorcycling.

For innovation to be successful therefore it has to proceed at a reasonable pace, a pace at which it can be readily absorbed by the market. Many innovations, however, came far too soon and so much so that almost all the significant innovations in motor cycle development for the next fifty years were first thought of and tried out in these earliest years of the industry. Such a surfeit of innovation could be disastrous for the firms which had put their resources into it, and in fact most of the the radical innovators did rather badly especially when compared with more conservative producers.¹⁰⁰

Success came to Triumph and their imitators because of their commitment to the standard product. As a result of this commitment, and as will be seen in the next chapter,

they paved the way for the entry to the industry of some larger and older firms which hitherto had waited on the sidelines.

CHAPTER 9

STANDARDIZATION, 1908-1916 (1): THE INDUSTRY

This chapter and the three following all deal with the final period covered by the research, the standardization phase of the industry's development. This one is mainly concerned with the expansion of the industry through the entry of many firms new to motor cycle manufacture. Of these new entrants, some were innovators, some were imitators, but both groups played significant parts in the growth of the British industry into the world's largest exporter of motor cycles.

The industry's growth was brought to an end, albeit temporarily, by the war. This was not the end of motor cycle production, however, as firms which produced motor cycles for military use were kept very busy.

The chapter breaks down into three main sections: entry, the growth of the industry, and a detailed account of motorcycling during the first two years of the war.

Introduction

In the earlier days of motor cycle production and particularly after the development of the Minerva and the new Werner, a large number of firms joined the industry in a very short space of time. They did this despite a product, which, except for record-breaking purposes where the rider's comfort was of secondary importance, was still unproven and would need substantial further development before it could be seriously considered as a practicable form of personal transport. At that stage the market was extremely limited, with the result, as we saw in the last chapter, that surprisingly early in its history, the industry became a victim of its own overproduction with many firms dropping out only a year or two after their entry.

By 1907 the industry's annual output of motor cycles

had fallen to less than 4,000, substantially down on what it must have been two or three years earlier, and contemporary observers began to look upon the motor cycle as no more than a passing fad: "Motor-cycling was considered a new craze and a dangerous pastime which, like roller skating, would eventually die out".¹

Such a conclusion would have been unduly pessimistic, however, since the news was not all bad. Many of the drop-outs were producers of poor quality machines which had been copied from elsewhere and put into production without significant improvement. There was certainly no future in the industry for such firms. If a firm is to survive by imitating the products of others, it must first find a product worth imitating, and until 1905 or 1906 there were few if any products in that category. Thus many of the firms which left the industry were no great loss, and meanwhile there were always at least a few others which set out to develop better products either along the lines of the developing standard, or in the form of designs which were rather more original. If 1907 were the industry's low point, therefore, it was also probably the year of its greatest promise for the future to anybody who had any real understanding of motor cycles and motor cycle technology.

Triumph was by now the leader in terms of both production and the quality and performance of its product. If we take the figures² as accurate, in 1907 Triumph produced more than a quarter of the entire output of the industry. There has always been some justification, therefore, in the claim that Triumph virtually saved the industry from extinction, and this claim has grown up not as a legend of more recent years, but was originated at the time by people close to the industry: "to it [Triumph] unquestionably is due the credit for rescuing the motor bicycle from oblivion to which it was being consigned".³

But Triumph did much more than support the industry through the more difficult years of 1905-7: "To the excellence of the Triumph workmanship and to the standardized design of their machine is largely due the gigantic

proportions to which the motorcycle trade has grown to-day".⁴ In effect, by developing a product of high quality and performance and at the same time one that was easily imitated, they paved the way for many firms which had so far remained aloof, not just to enter the industry, but to do so with immediate commercial success. At last the imitators could come into their own and build motor cycle production into a really big industry. In the years immediately preceding the first world war the industry owed much of its rapidly increasing output to these imitators, but they fell far short of having things all their own way. As we shall see later, despite the trend to standardization, the industry was never short of innovators.

Entry

Of the five categories of entrant suggested in Chapter 7, the inventors and inventor-inspired firms were easily the most important group of firms in the earliest period of the industry's development because they were virtually its creators. Without a product, however bad, there could have been no industry. The main drawback at that time, as in the earliest days of almost any industry, was that the products were essentially experimental models. Early experimental models will work after a fashion, but are almost invariably lacking in one or more of the design principles which are required to produce a technically sound product. Thus without a radical redesign they are likely to lack the potential to be developed into the kind of product which can both sell in large numbers and survive for a reasonable length of time in the marketplace.

The better models which emerged around 1900 and 1901 were of fundamentally superior design to earlier products so that, although they may not have worked too well initially, they did have the potential for further development that had been lacking hitherto. Thus the most important group of firms to enter the industry from 1901 onwards consisted of those which concentrated on improving existing models. These were the developers and they represented the

more successful firms of the period including such as Rex, Triumph and Phoenix. Out of this development effort from a relatively small number of firms, there emerged the Triumph model of 1907 which was to become the industry's first enduring standard, and the machine which the majority of entrants to the industry from 1908 and for several years thereafter, wanted and were almost compelled to imitate.

The imitators had always represented the majority of firms in the industry. Lacking new ideas or the technical ability to develop something significantly better from existing models, imitators would offer a product almost identical to one already on sale elsewhere. This was always a poor strategy when existing products were of doubtful quality or capability. But the situation changed radically once it was possible to imitate a really good product.

The arrival on the scene of a firm like Triumph producing, from 1907 onwards, a thousand or more high quality machines a year, left little doubt that the industry was emerging at last from its rather frustrating and often disastrous pioneering years. This was the signal that many firms had been waiting for. They now knew not only that the industry offered good prospects for commercial success, but also how that might be achieved: imitate Triumph. They did.

The Newcomers

It would be rather misleading to suggest that all firms which entered the industry either set out to imitate Triumph or had any intention of doing so. Some set out to innovate before finding it commercially expedient to follow the lead of Triumph. Others probably set out to develop a machine in line with popular taste only to discover, later, that it had to be almost an exact copy of the Triumph. Yet others may have set out deliberately to copy the Triumph as the only sensible path to take. There was a significant minority, however, which set out to innovate and succeeded in doing so.

According to a contemporary observer, the key factor was the background of the firm: "There is hardly an instance where a cycle firm introduced a machine which was not modelled on the Triumph. The list is extraordinary, and includes such well-known makers as the B.S.A., Rudge, Rover, Swift, Components, Bradbury, New Hudson, Sunbeam, Premier....."⁵ In contrast, "although there were many designs differing from the orthodox 3½ single cylinder, none emanated from the cycle makers, but were made by firms distributed all over the country, who were quite unknown in connexion with the cycle trade, namely, P. & M., Bat, Scott, Douglas, Matchless, Clyno".⁶ But before examining any of these firms, it would be of interest to consider the performance of one which might fit into either category: Veloce.

Veloce was the descendant of a firm known as Taylor Gue which had first produced cycles in the 1890s. It had been briefly involved with the motor cycle industry as suppliers of frames to Ormonde during 1901-4, but had failed and gone into liquidation in 1905. A new company was soon formed to produce bicycles and in 1908 it decided to re-enter the motor cycle industry. Percy Goodman, the son of the founder of the company, decided at that point that the way to enter the industry successfully was to develop something radically new. The result was a unit construction model which aroused considerable interest. Sales were poor, however, and so the firm decided to increase their range by adding a new model designed along the lines of the Triumph.⁷

Clearly, innovation was not an easy path to follow, especially when the industry standard had only recently been established. The company persisted, nevertheless, with its more innovative models and became well known as a producer of lightweight two-strokes in the years immediately preceding the war. Thus although Veloce produced a Triumph type machine, it was really more to be ranked with the inventors than the imitators. Much more typical of the imitator was BSA, the largest firm to enter the motor cycle

industry.

BSA was a long established firm, had been involved with the cycle industry on and off since about 1880, and from the 1890s onwards had supplied frames in large quantities, first to the cycle industry and later to the motor cycle industry. The first significant step to entering the motor cycle industry as a manufacturer of complete machines was the merger in 1907 with Eadie Manufacturing Company, the largest manufacturer of cycle parts after BSA itself. In 1908 Albert Eadie, now a director of BSA, was given the task of looking into the matter of motor cycle manufacture. He assembled a team of experts⁸ but the result (fig. 9.1) was a product virtually identical to the Triumph, in effect the kind of machine that almost any firm might have decided to produce. Thus, as was observed at the time: "There is no radical departure in the design, for the new B.S.A. is a $3\frac{1}{2}$ h.p. belt-driven model with 85 x 88 mm. engine, and the aim of the designers has obviously been to adopt well-tried principles".⁹ The only significant difference was in the

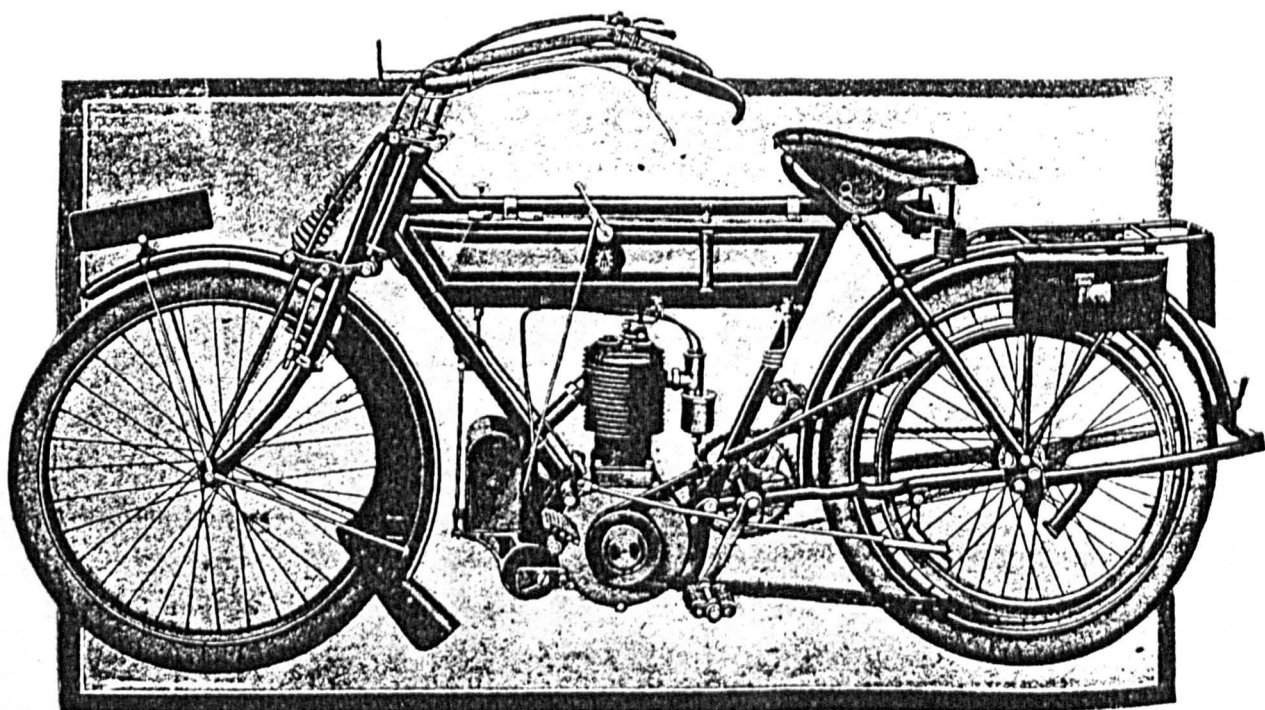


Fig. 9.1. The First BSA
("The Motor Cycle", 27 October 1910)

spring forks, but far from being a drawback this lack of innovativeness was an advantage. A thousand machines were produced in the first year and every one was sold.

Another firm which produced its first motor cycle in 1910 with a machine built according to what were by now recognised as "accepted principles",¹⁰ was **Rudge-Whitworth**. Rudge was among the longest established of cycle firms with a history going back to 1870. By 1909 it was one of the largest cycle producers with an output of 1,500 machines a week. In that same year the decision was made to produce a motor cycle, but this was to be no ordinary machine.

Secret experiments were begun in 1909 to develop a new engine. The first machine was assembled in July 1910, but there were problems with the cylinder head which had to be redesigned. The next model failed and the next, but the fourth proved a success and was soon setting new world records.¹¹

As it turned out, the first Rudge motor cycle (fig. 9.2) looked much the same as all the others which followed the lead of Triumph, but its performance was quite out of the ordinary. It was no simple copy and showed all the signs of becoming a world-beater, but it had cost them

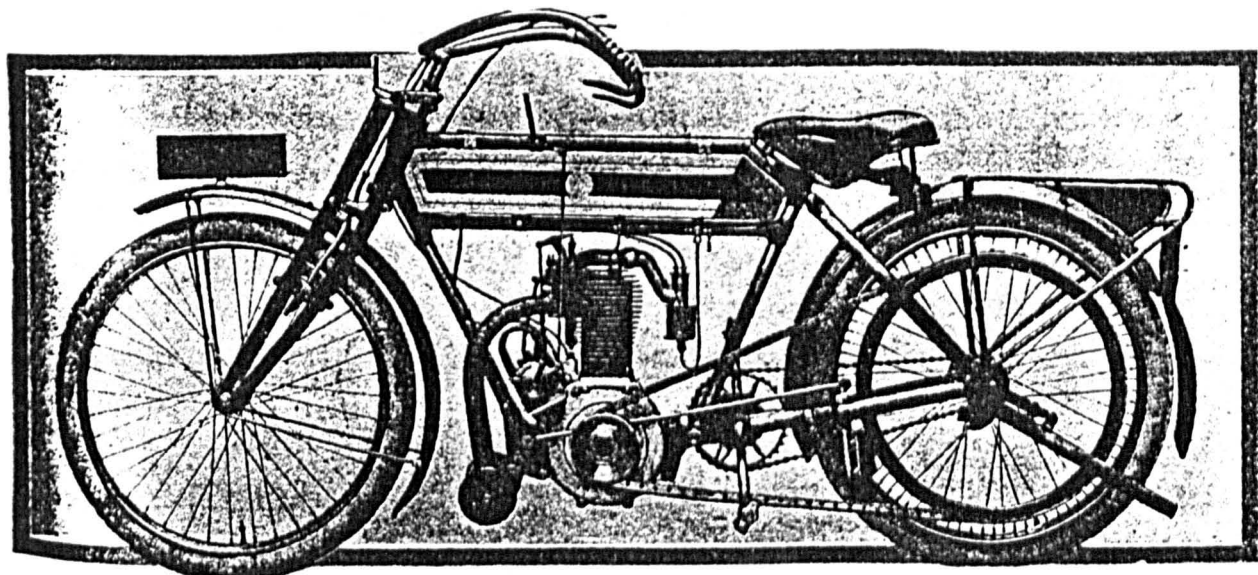


Fig. 9.2. The Rudge
("The Motor Cycle", 6 October 1910)

dear. In 1908 their profits had been £15,860. These had fallen in 1909—when they commenced work on the motor cycle—to £1,733. In 1910 and 1911 they made losses of £11,857 and £25,795 respectively¹², which were partly but not entirely the result of development work on their new machine.¹³ These disastrous years for the firm, however, were followed by better things. In 1912 profits had recovered to £25,099, but the greatest success eluded them for another two years. In 1913 they took second place in the Senior TT and did not win it until 1914. Such a win would normally have consolidated and increased their share of the market, but coming just before the outbreak of war it was too late and it is doubtful if the losses of 1910-11 were ever fully recouped.

Rudge was not the only firm which entered the industry with an improved but essentially standard machine. Another which was not content simply to imitate the Triumph was New Hudson.

New Hudson entered the industry in 1910 and was among the first to introduce a machine with a three-speed gear at a time when many machines were single-g geared. The firm engaged in a prolific advertising campaign which was able to exploit its competition successes as well as the technical attributes of its product (fig. 9.3), and succeeded so well that within about two years of its entry to the industry it had grown into one of the largest motor cycle manufacturers. By 1912 it was producing over fifty machines a week¹⁴ which, if sustained throughout the year, would have given it an annual output of near three thousand. This was the most spectacular rise of a newcomer to the industry, but not every firm wanted to aim at the mass market.

Sunbeam was a producer of high quality bicycles with a history going back to the 1880s. Quality was always put before price and consequently the firm had remained small. The first Sunbeam car was produced in 1899 and Sunbeam eventually became one of the big names in the motor industry, but John Marston, the firm's founder, was less

NEW HUDSON

3-SPEED MOTOR CYCLES

COMBINE THE HIGHEST IDEALS
OF LUXURY IN MOTOR CYCLING.

PERFECT RELIABILITY AND EASE OF CONTROL.

A.C.U. Reliability Trials

(Yorkshire) 25th APRIL, 1911,

Two First Class Non-Stop Certificates
(Only Six First Class Certificates were awarded)

Also Second in Heavyweights Class.

OUR LATEST MODEL No. IV B.

Three Speeds.
Free Engine.

Mechanically operated
Valves. B. & B. Carburetter
Bosch Magneto.
Druid Patent Forks.
Brooks Saddle.
Powerful Brakes.
Dunlop Tyres.

PRICE, COMPLETE

47

Guineas.

**SPLENDID ASCENT
OF
SUTTON BANK
AND
LYTHE BANK.**

New-Hudsons dis-
qualified for excessive
speed.



H. GRAHAM DIXON
on his 2½ h.p. New-Hudson

Write for Catalogue giving full specifications of this and other Models.

SWEEPING SUCCESSSES.

SHAP FELL.

Westmorland M.C.C. Open Hill Climb—

Fastest Time Class 1 2nd, & 3rd Class 2

Harrogate Hill Climb, 15th April, 1911.

TWO NEW-HUDSONS ENTERED & GAINED

Three Firsts & Three Seconds.

CLASS 4, LIGHTWEIGHTS,	1ST & 2ND
CLASS 5, TOURING SINGLES,	1ST & 2ND
CLASS 8, SINGLE-CYLINDER, ALL COMERS,	1ST & 2ND

"The Three-Speed New-Hudsons went up at a most
extraordinary rate."—*Motor Cycling*.

THREE GOLD & THREE SILVER MEDALS.

KOP'S HILL CLIMB (Open),

8th April, 1911.

A particularly difficult course.

**Two Firsts &
Two Seconds.**

1st & 2nd
CLASS 1.
TOURIST TROPHY

2nd & 4th
CLASS 2.
TOURING LIGHTWEIGHTS.

1st
CLASS Y.
VARIABLE GEAR.

Two Gold Medals.

"Their achievements
form a striking testimony
to their reliability."—
Birmingham Gazette.

ALL ON NEW-HUDSON 3-SPEEDS.

NEW-HUDSON CYCLE CO., LTD. Works: BIRMINGHAM

Fig. 9.3. New Hudson Advertisement

("Motor Cycling", 2 May 1911)

impressed by the motor cycle and did not seriously consider entering the motor cycle industry until 1911 when he himself was 76.

A designer from outside the firm was brought in and instructed "to design and bring to production a motorcycle that was fit to bear the Sunbeam name, that was to be easy to ride, dignified in appearance and, in the era of staccato exhausts and oil-spattered riders, would be quiet and free from mess".¹⁵ The machine turned out to be of conventional design and appearance apart from luxurious features such as deeper mudguarding and chain covers. There were no concessions to price at the expense of quality with the result that price was high and production was slow, not through any lack of demand but because manufacture was initially on a "hand-built" basis so that there was usually a waiting list for Sunbeam machines.¹⁶ A later model took second place in the 1914 Senior TT, a remarkable performance for a machine which was originally intended to be a "gentleman's motor cycle".

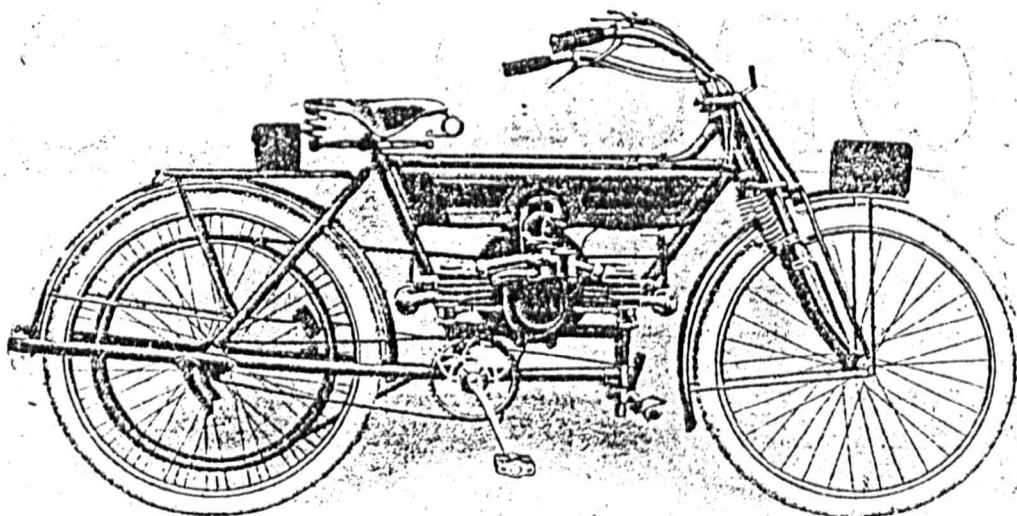
Apart from minor variations, all of these firms entered the industry with machines which followed in principle the standard pattern which had been established by Triumph some years before. The BSA was the nearest copy, the first Sunbeam was of 2½hp instead of 3½ and had a countershaft gear, but did not change significantly the standard pattern. The ease with which such machines were sold in large numbers by newcomers to the industry demonstrates the wisdom of this strategy. There were many other firms, some old, some new to the industry, which did no less well at this time, most of them by producing the standard type of machine, but certainly not all. In many ways the more radical innovators are more interesting. The most important of these was Douglas.

Douglas had no previous connection with the cycle industry. The firm originated in 1882 as a small blacksmith's shop and later developed into a foundry supplying lasts to the boot and shoe trade. It first became involved with the motor cycle industry in 1905 when it began to

supply cylinder castings to a firm called Light Motors which produced a small motor cycle with a horizontally-opposed, twin-cylinder engine. This was the first engine of its type intended for motor cycle use, and had been developed by the works manager of Light Motors, Joseph Barter, who was originally inspired by an engine of similar type developed for the Lanchester car.¹⁷

When Light Motors went into liquidation in 1907, Barter went to work for Douglas. An improved engine was developed and installed in the first Douglas motor cycle but initially it met with ridicule: "The Douglas was exhibited at the Show in 1907 and everyone went to look and laugh and not one order was taken".¹⁸ Yet apart from the engine, the Douglas was quite conventional in appearance (fig. 9.4). The engine alone made it look rather different, and the machine's initial reception demonstrates just how

THE DOUGLAS.



The British Lightweight that beat all others in the London to Plymouth and back A.C.U. trial and was awarded medal and silver cup for the best performance. In the quarterly trial, October 17th, all Douglas machines entered made non-stop runs, beating all lightweights up Dashwood and Gore Hill, Amersham.

Mr. B. H. Davies writes: "My appreciation of the little Douglas after such a trying ride was naturally profound. Few magnetos are so entirely waterproof. Its position high up on the top of the crank case has doubtless much to do with this. The little engine swallows all its own vibration, for I never once felt any tremor from it, and it pulled like a good 'un through the frightful mire."

Please write for details to—**DOUGLAS BROS., KINGSWOOD, BRISTOL.**

Fig. 9.4. Douglas Advertisement
("The Motor Cycle", 2 December 1908)

important it is for a product to conform to standard expectations particularly where appearance is concerned.

The machine survived, however, although progress was slow. In 1908 only 50 were sold, but in 1909 this had risen to 350.¹⁹ The Douglas was to prove itself in various ways. First, the horizontally-opposed twin engine is an extremely smooth-running type, and at a time when motor cycles were notorious for vibration, riders were bound eventually to discover the advantages of the Douglas. So much development work on the machine followed, including the addition of a two-speed gear,²⁰ that at the end of 1910 it was noted that the firm "have improved and developed it until it stands out as perhaps the most successful machine of its power on the market, and one of the sanest and most practical types".²¹ Competition success also was considerable, so much so that in 1912 the firm took two full pages of "Motor Cycling" to advertise in small print and without the distraction of illustrations, all the Douglas' sporting successes in that year alone, which included first, second and fourth places in the Junior TT.²²

By now production had increased substantially as compared with earlier days. In 1910 it had exceeded a thousand, by the following year had reached two thousand, and in 1913 contracts for the following year to supply 6,000 machines were reported.²³ The only firm which might have been producing more machines at this stage of the industry's history, was Triumph.

The success of Douglas as an innovator owed much to the fact that the basic format of the machine was very much in line with the accepted standard. If the main innovation had been in frame and not engine design, then the resistance to it would have been much greater. This point can be confirmed by reference to some of the more innovative machines discussed in the last chapter, and also to the James.

James originated as a cycle firm and was not a new entrant to the industry. It had been producing motor cycles since 1901 but always with proprietary engines, and

it was not until 1908 that it produced a machine entirely of its own manufacture. The new model was exceptionally innovative and rather unconventional in appearance (fig. 9.5). It was designed to answer many of the deficiencies of current machines, and among its more unusual features were the "outrigger" spindles which carried the wheels. These made it possible to change the wheels in seconds for tyre repairs, an important feature when punctures were common.²⁴

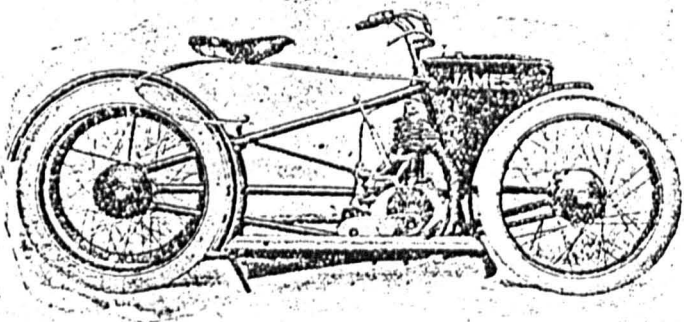
This and other advantages which made it one of the most innovative machines of its day were, nevertheless, insufficient to overcome the prejudice against radically new designs, and the machine which had taken three years to develop was dropped within three years. It was replaced by a model which was no less innovative in detail features but

The JAMES

MOTOR CYCLE

THE "ONE-TRACK CAR."

GOVERNED BALL BEARING
ENGINE, 88 x 90 MM.
FREE ENGINE.
EXPANDING PULLEY.
INTERCHANGEABLE WHEELS.
TYRES READILY DETACHABLE.



LIVE AXLES.
HANDLE STARTING.
METAL-TO-METAL EXPANDING BRAKES.
SPRING FRAME AND SEAT.

PRICE: £48 0 0 NETT CASH.
DESCRIPTIVE CATALOGUE POST FREE ON APPLICATION.

The JAMES CYCLE Co., Ltd., BIRMINGHAM.

DEPOTS AND SHOWROOMS { LONDON: 140, Southampton Row, W.C.
LIVERPOOL: Slater St., Bold Street.
BIRMINGHAM: Broad Street Corner.

Fig. 9.5. James Advertisement
("The Motor Cycle", 2 December 1908)

cast within the conventional mould.²⁵ Thus once more the standard had prevailed against the more innovative product, yet under certain circumstances radically innovative machines could and did survive, and none more so than the Scott.

The Scott was one of the most innovative motor cycles ever devised. It was the invention of Alfred Scott who was born in Bradford in 1874, educated at a public school, and trained by apprenticeship as an engineer.

Scott first began work on a twin-cylinder, two-stroke engine in 1897, and mounted the finished article on a bicycle, Werner fashion.²⁶ It was early days yet, however, to think about manufacture, and Scott continued his development work for the next ten years before he began to arrive at a machine which might be marketable. Meanwhile, he had developed various other ideas including a marine engine and an electric clock which was taken up eventually by the Ever Ready Battery Company.²⁷

The first Scott motor cycles were manufactured in Bradford by Benjamin and William Jowett by arrangement with Scott who lacked the capital to set up his own firm. Only six were produced before the Jowetts decided to end the contract so as to concentrate on car manufacture.²⁸ These first machines gave much trouble but even so, one of them, ridden by Scott himself, performed extremely well in hill climbs. The major problem now for Scott was to set up his own company.

Capital of £4,000 was subscribed by Scott's relatives and a few others and the Scott Engineering Company was formed, but the path to radical innovation is rarely easy and the new machine had to undergo several modifications before it could be put into production in 1909.²⁹

As can be seen from the later but little changed version of this machine illustrated in fig. 9.6, this was an unusual motor cycle and of rather untypical appearance. The fully triangulated, open frame was of Scott's own design and intended to place the engine and petrol tank as low as possible so as to improve stability.³⁰ The engine,

2 SPEED
2 CYLINDER
2 STROKE

SCOTT

THE IDEAL MACHINE FOR MOTOR CYCLE.

SPEED: WINNER 1912 T.T. RACE.
FASTEST LAP 1912 T.T. RACE.
FASTEST LAP 1911 T.T. RACE.

RELIABILITY:

SCOTCH SIX DAYS.
ENGLISH SIX DAYS,
LIVERPOOL WINTER TRIAL,
ETC., ETC.

HILL-CLIMBING:

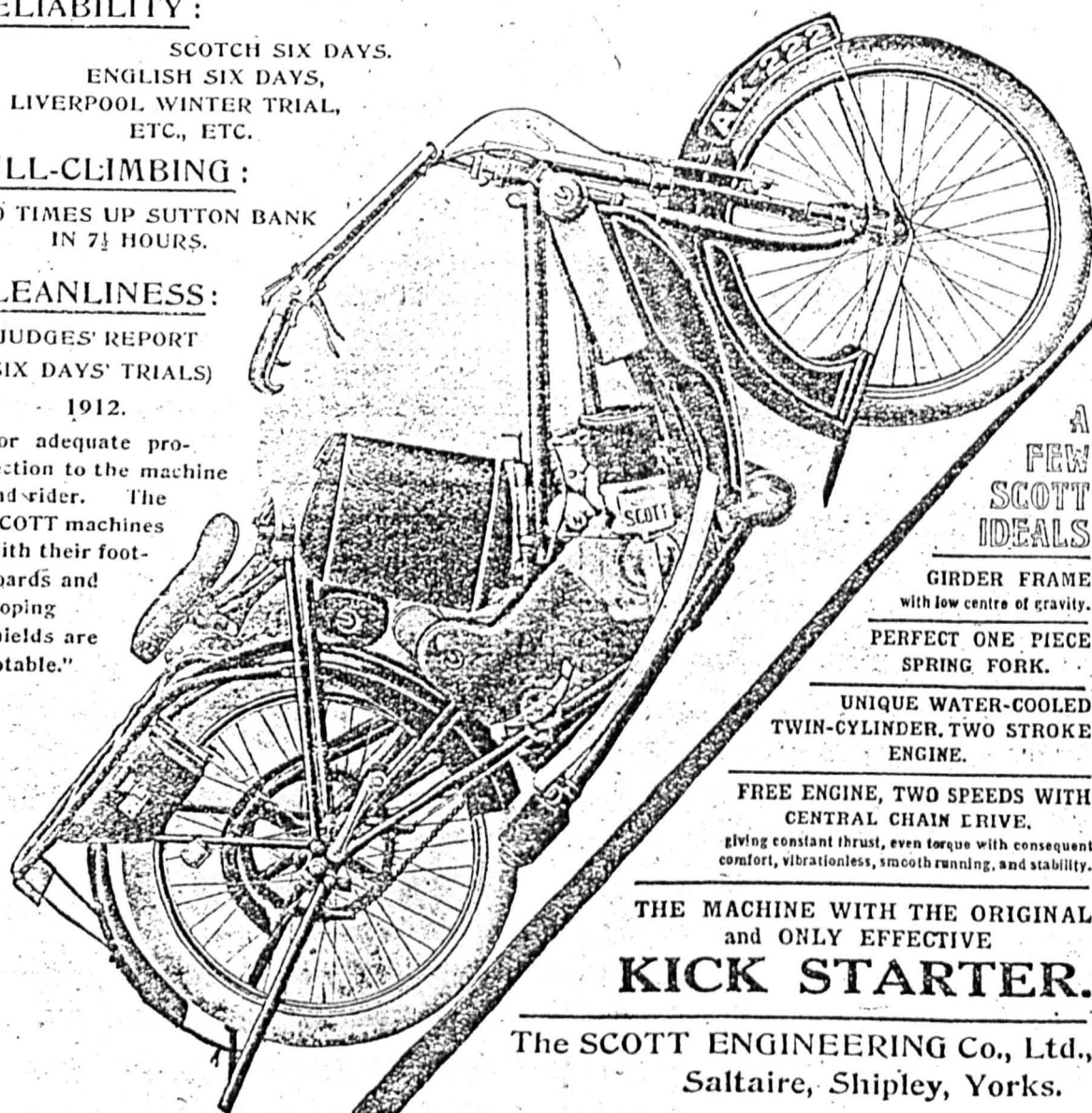
100 TIMES UP SUTTON BANK
IN 7½ HOURS.

CLEANLINESS:

JUDGES' REPORT
(SIX DAYS' TRIALS)

1912.

"For adequate protection to the machine and rider. The SCOTT machines with their foot-boards and sloping shields are notable."



A
FEW
SCOTT
IDEALS

GIRDER FRAME
with low centre of gravity.

PERFECT ONE PIECE
SPRING FORK.

UNIQUE WATER-COOLED
TWIN-CYLINDER, TWO STROKE
ENGINE.

FREE ENGINE, TWO SPEEDS WITH
CENTRAL CHAIN DRIVE.
giving constant thrust, even torque with consequent
comfort, vibrationless, smooth running, and stability.

THE MACHINE WITH THE ORIGINAL
and ONLY EFFECTIVE
KICK STARTER.

The SCOTT ENGINEERING Co., Ltd.,
Saltaire, Shipley, Yorks.

Fig. 9.6. Scott Motor Cycle Advertisement
("The Motor Cycle", 27 February 1913)

a twin cylinder, two-stroke, was original in conception, and it was this more than any other feature which had engaged Scott's attention during most of those ten years of development work. There were many other original features including a pedal gear-change, and a kick-starter, which made the machine of advanced specification in almost every detail. Performance was extremely good, so that the only real problem which faced the new company was how to sell such an innovative motor cycle.

The first factor which enabled the Scott to overcome the prejudice against almost anything so original in design, was the machine's immediate and continuing success in competitions. BHD recalls how it performed at one of its first competition appearances in 1908:

In envious company it is seldom that spite and criticism automatically surrender to worship. Scott, in ten minutes, conquered the motor cycle world. The mere look of his epoch-making machine was sufficient. Gleaming with silver-plate and purple enamel, its sheer beauty immediately vanquished the onlookers. It made three ascents of the hill. We all felt that a new era had dawned on our world. He started the machine by a gentle depression of a short pedal—none of that ungainly run-and-jump business. He had scorned to fit pedals. The smooth, cat-like purr of the two-stroke engine put to underlying shame the staccato chatter of the super-tuned four-strokes which had mustered to steal all the day's glory. Amidships, the trim little projectile housed a two-speed gear, complete with clutch, daintily operated by a single rocking pedal. Finally, the entire drive was by very light chains.³¹

On that occasion Scott collected three gold medals and, in time, Scott riders would collect many more, but with such an untypical machine, wins in lesser competitions were not enough to overcome the resistance of the typical motorcyclist. In 1911 production was 300, far below the thousands of relatively unoriginal standard machines being produced by firms like BSA and New Hudson, after an

equally short period in the industry. What was needed was a win in the most important competition of all, the TT.

The first machine, entered in 1909, failed to finish. The following year two Scotts finished but were not among the leaders. In 1911, as a result of technical problems, only one of three machines entered finished. Not until 1912 did a Scott win and again in 1913. The effect on the company's business was startling. Production in 1912 reached 550,³² the maximum capacity of the factory and Scott production was booked up for years ahead. In response, the company went public in order to raise capital to build a new factory.

Scott was the exception which proves the rule. It was the only firm which succeeded unreservedly with an entirely original product, designed solely with regard to efficiency and which made no concession to convention. This success was owed almost entirely to the ability and tenacity of Alfred Scott himself, a man to match the inventor of legend who succeeds in story books but very rarely in the real world. In comparison, firms like BSA could enter the industry and with very little development produce a highly successful motor cycle. The time was ripe in the industry, not for radical innovation, but for consolidation and expansion: "All that has appeared to be necessary was for a firm of repute to announce that they were in a position to supply a motor bicycle for their resources to be immediately taxed to supply the demand. We have notable examples of this in BSA, Rudge-Whitworth, Humber, Premier, Singer, Enfield, New Hudson, James, Alldays and Onions, Rover, Ariel, Swift, Hobart Bird, and other concerns".³³

Not all of these firms produced entirely standard-type machines and, indeed, it was not strictly necessary for a firm to produce a close copy of the Triumph in order to make money. There was in fact still a fair number of successful firms which produced machines which were moderately different from the Triumph.

Many of these were long established in the industry, like P & M, for example, which had its own unique design in

which the engine replaced the front down-tube of the frame. Others, like Levis, were newcomers and produced lightweight machines which were developing into an increasingly important product class. The key factor for commercial success was to produce a machine which was of conventional layout, and therefore conventional appearance, whatever its weight or type of engine. An engine would survive or be rejected according to its performance, and not its appearance, but the motor cycle, the complete package that was placed on the market, had to look right.

The more technical issues will be discussed in the next chapter. First we come to examine the progress and growth of the industry as a whole.

The Growth of the Industry: A Statistical Review

By the end of 1916, something like three hundred firms had entered the industry since its beginnings in 1896, of which about a hundred remained to continue or resume production after the war. The complete table of the entrances and exits of these firms can be found in the next chapter.

Of more immediate interest are the years 1908-1916, which included the second expansionary period and probably the most important one of the industry's entire history. As can be seen in Table 9.1, 112 firms entered the industry in this period and 106 left it. In 1908, the tail-end of the slump, firms were still leaving the industry faster than new ones were entering, but from 1909 to 1912 only 21 firms left while 60 entered.

1913 found the industry bigger than it had ever been in terms of the number of firms in it, yet already there were fears that the market was becoming saturated and the industry might soon be in difficulties: "There are now so many firms producing motor-cycles, and such large outputs being accomplished, that apparently the limits of public absorption have been reached, and the moment has arrived when the business must assume a competitive aspect".³⁵ As we shall see, there was little evidence to justify these fears. The outbreak of war in 1914, however, put quite a

Year	Entrants	Leavers	Remainder
1908	10	16	90
1909	12	3	99
1910	10	4	105
1911	20	8	117
1912	18	6	129
1913	26	12	143
1914	11	30	124
1915	4	20	108
1916	1	7	102
Total	112	106	

Table 9.1. Firms Entering and Leaving the Industry,
1908-1916³⁴

different complexion on things, and the number of firms remaining active in the industry fell sharply.

1913 was also the first year in which there was a significantly greater number of firms in the industry than in the previous peak year of 1905, but production was by now several times larger. While there are no production figures for the industry as a whole except for 1907, the Census of Production year, figures of motor cycles in use provide a much better guide to the growth of the industry than the number of firms. As can be seen in Table 9.2, the number of motor cycles in use was 34,664 in 1907, and had only risen to 36,242 by 1910. But from then on there was very rapid growth to the effect that by 1914 the total had increased almost three and a half times to 123,678. The peak year for growth, 1913, showed an increase of 28,283.

In order that the British industry could have supplied all of this increase, it had to be producing well over thirty thousand machines a year so as to allow for the scrapping of old ones. In fact production was much higher since the excess of exports over imports, as shown in Table 9.3, was 15,122 in 1913, and 18,318 in 1914, which would

Year	Motor Cycles in Use	Increase
1907	34,664	
1908	35,247	583
1909	35,784	537
1910	36,242	458
1911	47,572	11,330
1912	69,501	21,929
1913	97,784	28,283
1914	123,678	25,894
1915	138,496	14,820
1916	152,960	14,464
1917	118,806	-34,154
1918	69,206	-49,600

Table 9.2 Increase in Motor Cycle Use, 1907-1918³⁶

indicate that the total output of the industry was probably at least 45,000 by 1914.³⁷ Thus there was something like a twelvefold increase in production from 1907 (3,700) to 1914.

The performance of some individual firms was no less impressive. Triumph's output had risen from a thousand in the whole of 1907 to 115 machines a week in 1911,³⁸ about six thousand a year. Douglas which was a newcomer to the industry and produced only 50 machines in 1908, was, by 1914, also producing at least six thousand.³⁹ New Hudson, and P & M, and probably BSA, were producing at least two thousand machines annually by 1913,⁴⁰ and several others probably a thousand or more. Thus it is likely that at this time the top ten or twelve firms were producing at least half the industry's total output, which would have left not much more than 22,000 machines to be shared between about 130 firms, an average output for the latter of about 170 each.

This mixture of large and small firms was a mark of the industry's strength. The larger would cater for the growing mass market which represented the best prospect for

future expansion. The smaller firms were always the best source of innovative ideas: "One of the best augurs for the future of the motor cycle is the fact that a number of smaller firms whose more modest organisations do not permit them to compete on level terms with the big manufacturers, are turning their attention towards the development of special types of machines".⁴¹

One such innovative small firm was Corah which developed an engine with rotary valves. The firm has been described in a letter from Neville Hall, a former employee, in a letter to John Pollitt, a collector of documents on motorcycling history: "In 1909 I was with a small firm at King's Norton. They made the Corah motorcycles in a small way. R.N. Corah's father was a bearded old gentleman of the Edward VII type, suffered from gout, retired and lived in the big house on the Redditch Road. R.N., the only son, was somewhat mechanically inclined and started to make m/cycles in the stables at the bottom of the drive. There were about 7 of us all told. The machine shop! 1 lathe, 1 vertical driller and 1 grindstone, were driven by a 4½hp de Dion engine.....Every time we sold a motor bike we had to take either an older m/cycle or car in exchange—it was lucky old man Corah had some money as we usually had quite a collection of 'take ins' in an old harness room".⁴²

In 1911 the firm marketed machines with its new rotary valve engines and equipped also with shaft drive, a very advanced specification at that time. Later it dropped its own engines in favour of JAP engines, and in 1912 a Corah-JAP set a new world record in its class. It ceased production in 1914, like many other small firms, a victim of the war. While it survived, however, Corah turned out a high quality product, and its history demonstrates that the smaller firms could still play an important part in the industry's development and growth.

As a result of such growth, Britain had, by the pre-war years, become the world's most important motor cycle manufacturer. As can be seen in Table 9.3, exports of complete motor cycles had increased from 800 in 1907 to

over 20,000 in 1914, while imports remained more less constant until the years of war-time scarcity. In 1913 the value of Britain's motor cycle exports amounted to £993,267, which was more than six times as much as that of the next major exporter, the United States, and gave Britain almost 70% of the world's export trade.⁴⁴

Year	Exports	Imports
1907	800	1,770
1908	1,048	1,340
1909	1,884	1,442
1910	3,341	1,387
1911	7,350	1,351
1912	13,055	1,363
1913	16,850	1,728
1914	20,877	2,559
1915	10,927	4,531
1916	12,847	1,192

Table 9.3. Exports and Imports of Motor Cycles,
1907-1916⁴³

The war caused a temporary contraction in the size of the industry, but was a significant period in the industry's history, nevertheless, as motor cycle production continued and actually expanded for some of the firms supplying the armed services.

The War

Many research studies end in 1914 as if to suggest that the outbreak of war was a natural break in the normal run of things. In some activities this was probably so, but industrial activity rarely comes to an end as a result of war. Many industries were much busier as a result of the war and this was the case for the motor cycle industry, or at least for those parts of it which did not either close down immediately through undue pessimism, or turn

over their production to armaments.

At the outbreak of war many firms "seized with panic which, perhaps, naturally pervaded the atmosphere at that time, commenced cancelling contracts in the expectancy of bad times, and, moreover, cut down staffs and encouraged many of their best engineers to join the Forces".⁴⁵ Within less than a month of the outbreak of war, however, the message came through from the Chancellor of the Exchequer to "Carry on".⁴⁶ It was to be business as usual and a degree of stability was restored to the industry. As it turned out, for some firms at least, there was much money to be made out of the war from motor cycle production.

The outbreak of war found the British Army notoriously unprepared. It was particularly lacking in motor cycle despatch riders and the kind of equipment they needed. Attempts were made from about 1912 onwards to set up a volunteer force of motor cyclists and these were taken further in 1913 with the setting up of both a Territorial Force and the Royal Engineers, Special Reserve Motorcyclist Section. Results were disappointing and failed to attract anything like the numbers needed: "The War Office, assisted by the R.A.C. and A.A., established a series of motor-cycle committees in every military district. These have failed to bring in recruits, and we are face to face with the melancholy fact that as far as our Regular Army (the Expeditionary Force and the Special Reserve) is concerned, we have no motor-cyclists".⁴⁷

The members of the Special Reserve were intended to provide their own machines, and the regulations regarding the standardization of motor cycles to be used in this capacity turned out to be quite significant. They were as follows:

(a) Motorcycles to be of a well-tried and approved make, of which adequate stocks of spare parts are available in the country, and fitted with variable speed gear and magneto ignition.

(b) Wheels to be 26 in. in diameter, with not less than 2½ in. tyres, for machines with engines of 500 c.c.,

and not less than 2 in. tyres for machines with engines of 350 c.c.

(c) Engine to be single-cylinder of about 500 c.c. capacity, with dimensions of not less than 84 mm. bore and 84 mm. stroke. A certain number of horizontal twin-cylinder machines of less capacity will, however, be accepted.⁴⁸

This early effort did more to establish the rules by which military motorcycling would be governed than to remedy the shortage of despatch riders. When the war began the shortage was so great that the War Office appealed for motor cycle volunteers and their equipment: "Each motorcyclist should bring his overalls, gauntlets, and goggles, if possible, for which, if in serviceable condition, he will receive an allowance of 15s. He should also bring his motor-cycle for inspection, when it will either be taken over by the Military Authorities at a valuation or be replaced by a new one".⁴⁹

Only a handful of motor cycles had been purchased by the armed forces before the war. The first order went to P & M in 1912 when a small number were required for testing. The P & M design (fig.9.7) was the oldest still in use

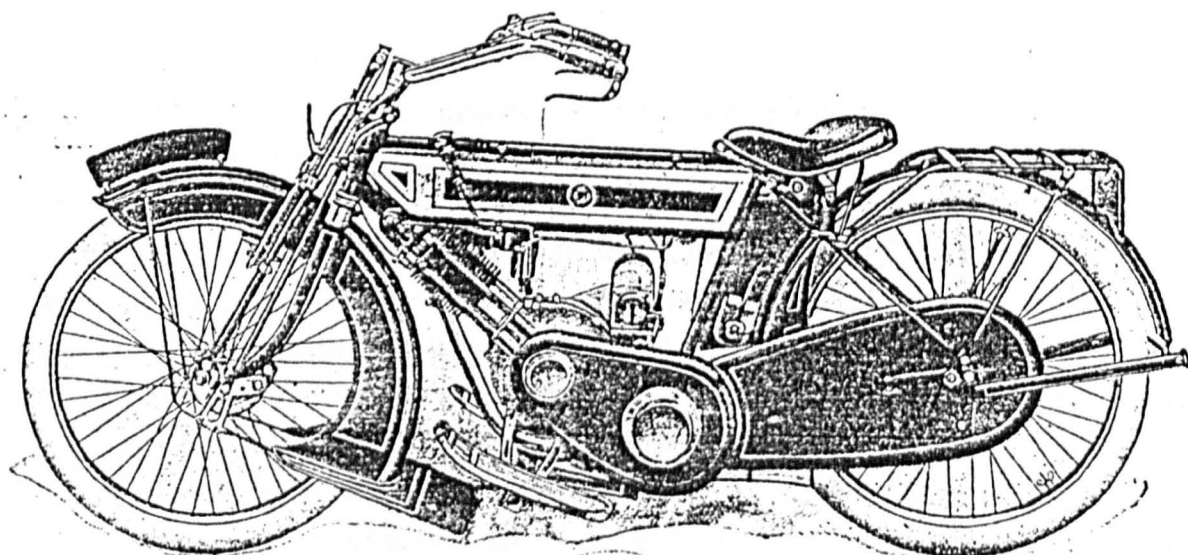


Fig. 9.7. The P & M
("The Motor Cycle", 9 April 1914)

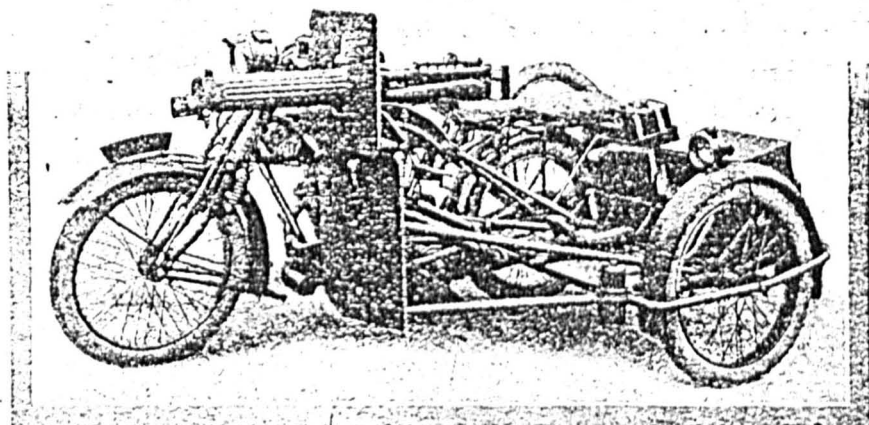
having originated in 1900 (see pp. 154-5). It remained totally unchanged in principle although unlike the Werner pattern in that the engine instead of being centrally-placed was installed so as to replace the front down-tube of the frame. This made for a particularly robust construction and the machine proved its reliability over many years. Following the outbreak of war the P & M factory was the first to be taken over for its motor cycle production, and during the war it supplied 6,000 machines to the Air Force and enough spares to make three or four times that number.⁵⁰

Two other firms were to play an even greater part in the war: Triumph and Douglas. In the 1913 regulations for motor cycles mentioned above, the single cylinder 500cc, that is the Triumph type, was preferred. Twins were not generally approved except for the 350cc, horizontally-opposed type, which could only mean the Douglas. By 1914 Triumph and Douglas were the two largest motor cycle manufacturers in the country and were fortunate in the policy of the War Office to set standards for motor cycles and minimise the number of different machines used. By the end of the war Triumph had supplied 30,000 machines⁵¹ and Douglas over 25,000.⁵²

For some reason the War Office rejected the V-twin for military use (perhaps the survival of an old reputation for unreliability), but approved it for sidecar combinations. The most important manufacturer in this respect was Clyno, the fourth firm whose production was fully committed to the war effort. In 1915 it doubled its capacity for the production of sidecar outfits and was said to be working at full pressure day and night.⁵³ Motor cycle-sidecar combinations were used in a remarkable variety of ways, for normal passenger carrying, as ambulances, as machine-gun carriages, and even as mobile laboratories (fig. 9.8).

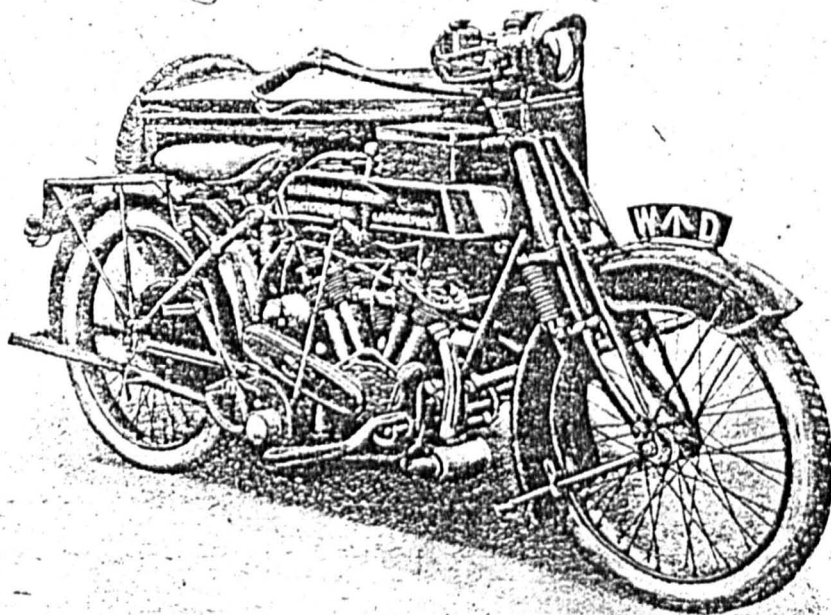
Many other firms supplied machines to the armed forces in smaller but substantial numbers, including BSA, New Imperial, Norton, Rover, Rudge, Scott, and Zenith.⁵⁴ Several supplied motor cycles to Britain's allies including

ROM (All British) TYRES



Fitted with ROM TYRES

The Clyno-Vickers Motor Machine Gun, adopted by THE WAR OFFICE.



Fitted with ROM TYRES

The Bacteriological Laboratory Clyno Machine presented by
H.R.H. Princess Christian to the RED CROSS SOCIETY.

ROM Tyre & Rubber Co., Ltd.,
36, Brooke Street, Holborn.

Telegrams—"Romdom, London."
Telephone—Holborn 1513.

("The Motor Cycle", 4 March 1915)

James, Premier, Sunbeam, Chater-Lea and Humber, all of which obtained orders from the Russian government.⁵⁵

Thus any reduction in civilian demand for motor cycles which might have resulted from the call to arms and the uncertainties of the war, was substantially offset by large orders for the armed forces. This factor combined with the reduction in productive capacity as many firms were required to convert to armaments production, left the motor cycle industry, or what remained of it, busier than ever,⁵⁶ despite the scarcity of essential supplies.

The shortage of raw materials, petrol and imported parts was a major problems for the industry. The loss of German imports was particularly serious since most of the magnetos used in British machines were made in Germany, but the problem was partially remedied by American imports,⁵⁷ and later by British production.

The scarcity of petrol and its high price might have deterred people from taking up motorcycling but it had the opposite effect, since it operated to the advantage of the motor cycle in comparison with the car as it was rather more economical on fuel. The result was that many motorists took up motorcycling and motor cycle use continued to increase in the first two years of the war, reaching a peak of 152,960 in 1916 (see Table 9.2).

Thus demand for motor cycles remained high and at a level which could not be satisfied by the British industry. The shortfall was met partially by an increase in imports, particularly from the USA.⁵⁸ The number of complete motor cycles imported increased from 1,728 in 1913, the year before the war, to 4,531 in 1915.⁵⁹ The country could not afford to maintain such a high level of imports, however, particularly in time of war, and in 1916 the import of motor cycles was banned.⁶⁰

The war itself provided the final proving ground for the motor cycle. Triumphs, Douglas', and P & Ms, were in general found to be suitable for war service with little or no modification. They were of good quality and strongly built for British roads which were little better than those

on the continent. Reports, however, were somewhat conflicting as to how well these machines performed.

A despatch rider after making a tour of a "scrap heap" of machines either broken or worn out, considered that many had been either neglected or misused; they had been ridden too fast over poor roads, often with the wrong kind of oil in the engine, and showed signs of lack of attention and adjustment. He concluded that there was a need to design a "W.D." model specially adapted for the harsh conditions in which it would be used.⁶¹ But despite the buckled wheels, the cracked valve seatings, the front fork cracked at the lower end, and other damage, most machines were able to do what they were intended to do and the majority of riders did not find a great deal wrong with them.

Cpl. A.J. Sproston, a despatch rider serving in the "deep mud and blinding dust" of Mesopotamia, seemed to be well satisfied with his Douglas:

I was never so convinced of the inherent excellence of the present motor cycle as I am to-day.....since those anxious days of Mons, I have seen few breakdowns directly traceable to faulty design or construction. The large number of mechanical casualties could almost wholly have been avoided by intelligent anticipation of, and provision for, abnormal strains and stresses by the rider.

The seas of slimy mud vividly recall the earlier days of the campaign in France. The machine slithers and writhes beneath me as I pick my way around and out of the holes in the 'road'.....Crashing and smashing along, my poor little machine is just flung about by the execrable mud heaps of the plains, plunging through paths of suffocating dust. Constant recourse to my water bottle, the liquid now almost to boiling point from the sun's rays, is the only method to avoid collapse. Heated chunks of air waft along, as hot as the gases exuded from the plucky little motor. When remounting after a stop, even contact with the burning saddle becomes torture to the body. This is motor cycling at 110° in the shade.

To digress somewhat, I would set out that this

wonderful behaviour of the motor cycles, and the treatment I have endeavoured to describe, is part of the daily routine. Certainly the journeys undertaken are short, but the accumulated mileage covered without mishap or repair is stupendous. In addition to drawbacks, we have no tools or organization to cope with breakages, and an all-round shortage of oil and petrol.⁶²

Clearly motorcycling had come a long way since the days when motor cycles could be expected to break down "in absolutely every single ride". But it was soon to be reserved largely for the military until the end of the war. Civilian motor cycle production was prohibited from 15 November 1916, just twenty years and a day after the Locomotive Act of 1896 made motorcycling on British roads practicable for the first time.

CHAPTER 10

STANDARDIZATION, 1908-1916 (2): THE MOTOR CYCLE AS TECHNICAL PRODUCT

As we saw in Chapter 8, what was almost certainly the most important period in the technical development of the motor cycle came to an end in 1907. From now on almost all attempts at a radical redesign of the standard motorcycle would be resisted. Development would continue, however, with the aim of improving the standard model and designing new engines which, while readily incorporated within the format of the standard machine, would give it greatly enhanced performance and new uses.

One or two of the radically new motor cycle designs of this period were successful, but were rarely imitated as a whole although some of the new features they introduced were widely adopted. It was a period of technical standardization despite the high degree of innovation which took place at the same time.

Introduction

Individual producers aim to standardize their own production so as to simplify manufacture and reduce costs, but producers across a whole industry will aim to differentiate their products from those of their competitors rather than make them similar. They will, however, imitate an industry standard when there is evidence to suggest that it will be to their commercial advantage to do so. When an industry is expanding rapidly it may be possible to imitate almost exactly such a standard, as represented by the product of another firm, and yet achieve instant commercial success, as did BSA. But when the industry's expansion slows, competition will increase and it will become necessary to improve products and offer something extra so as to gain a competitive advantage. Competition, then, and the

increased innovativeness it is likely to generate, will act against the trend to standardization at least in the short-run.

There is no constancy in human affairs. At all times there exist conservative tendencies and innovative tendencies which usually compete or conflict. Standardization is an aspect of the conservative tendency in that it operates so as to identify, select, intensify and perhaps universalize the best of what already exists in human affairs while rejecting the remainder. Innovation may build on an existing standard or replace it with something quite new. It may offer a better way of doing things or it may represent change for its own sake. In product development both cases can apply. In the interests of developing superior products there is a constant search for better ways of doing things, but there are times also when change is desirable for its own sake. However much a product has been improved, is being improved, and can still be improved, sooner or later consumers are going to become bored with it and want something different.

Thus standards are never final: they are bound to change, and in the process of change, any tendency or trend to standardization is bound to weaken for a time. It is always present but is never a constant. In examining the realization of the motor cycle industry's first definitive standard, therefore, we shall find that, almost as soon as it had appeared, there developed new ideas of sufficient importance to suggest new directions of development for the motor cycle and, ultimately, new standards.

The Standard and its Further Development

From 1908 the acknowledged standard was the Triumph. As we saw in Chapter 8, it was a long time developing and yet it was a conservative design. Triumph was not a firm to invest in new and untried technologies but was usually quick to recognise the more basic innovations which were likely to stay. Thus, subject to small but necessary improvements, the machine would be much the same year after

year which would enable consumers to get used to it and perhaps to recognise it as a sound, reliable product, a machine that would last.

Technically, the Triumph was rated as 3½hp. It had a single cylinder engine with mechanically operated inlet valve, a carburettor of Triumph make, and magneto ignition. The transmission was by belt and there was only a single gear, although it was adjustable to different ratios. There were spring forks but the frame was rigid and the machine was still equipped with pedals. This was fairly average specification at that time as can be seen by comparing it with the statistics of machines exhibited at the 1908 Stanley Show, in Table 10.1.

Motor bicycles:

with pedals	142
no pedals	48

All motor cycles:

engine	single cylinder	125
	two or more cylinders	82
valves	mechanical	117
	automatic	90
ignition	magneto	178
	battery	29
gear	single	147
	multiple	60
transmission	belt	190
	other	17
forks	spring	155
	rigid	52
frame	spring	17
	rigid	190

Table 9.4. Technical Statistics of Machines Exhibited at the Stanley Show, 1908¹

For every item listed, the Triumph comes in the most popular class, yet it was among the best in terms of

performance, and in fact demonstrably the best when it won the 1908 TT. It was not to remain so for long, but meanwhile the Triumph set the standard: "It created a national ideal—that of a simple design, on rugged lines, executed in first-class materials by first-class craftsmen, with simplicity as the guiding principle. In outline, it was widely imitated, but I doubt if any rival quite succeeded in duplicating its staunch simplicity".²

The Triumph was to remain the most popular motor bicycle until the war, but its performance in such major tests as the TT, was to decline substantially as more advanced machines, sometimes of radically new design, were developed by other firms. Triumph's development policy remained conservative almost until the war years, and so much so that the last single-gear machines to run in the Senior TT, the 1911 race, were Triumphs.³ This conservatism made it relatively easy for competitors to offer technically superior machines. They could not compete with the Triumph reputation, but they could offer advanced features which the Triumph lacked, and they could do this without ever having to change the main principles on which the Triumph was based.

As we have already seen, New Hudson offered a three speed gear and were among the first to do so, while Rudge developed an advanced and rather superior engine. Others like Sunbeam were to offer a countershaft two or three speed gear when Triumph had only just introduced their hub gear, a system which would soon be replaced.

The question of variable speed gears was probably the most important technical issue of the years immediately before the war. The idea was not new. Phoenix had introduced a machine with a two-speed gear as early as 1902, but very few others had followed their lead. By 1907 many firms were offering a variable pulley which enabled the rider to adjust the gear ratio of his machine so as to improve performance on hills, for example, but this system still allowed only the one speed.

When variable speed gears began to achieve more wide-

spread acceptance, they were usually either of hub or countershaft type. The hub gear was built into the rear wheel hub and did not require any change in the standard transmission system which usually involved a single belt from the engine pulley to a rather large pulley on the rear wheel. (The BSA, fig. 9.1, had this type of transmission system, though it was ungeared.)

The countershaft gear required two chains or a single chain plus a belt. The first connected the engine pulley to the countershaft which was placed immediately behind the engine, while the second chain (which could be replaced by a belt) connected the countershaft to a sprocket or pulley on the rear wheel. (See the P & M, fig. 9.7., though the chains here are cased.)

The hub gear was effective in use, easy to install, light in weight and simple in operation. Its main disadvantage was in the extra weight it placed on the rear wheel which might have a destabilising effect when the machine was in use.

For various reasons the countershaft gear was superior, and by 1914 the debate which had continued for several years was coming to an end: "Without a doubt, the counter-shaft gear is steadily growing in public favour, and as far as one can see at the moment, is the gear of the future. Its advantages are that it is much more simple in construction and has infinitely fewer parts to become deranged and require attention. These parts can also be made larger and more accessible than in the case of the hub gear. It allows of better weight distribution, and brings the kick-starter into a more convenient position. It dispenses with the long gear and clutch control rods, allows of larger diameter clutches, and involves a two step drive either by chain and belt, or by chain throughout".⁴

In their policy regarding variable speed gears, Triumph was conservative but probably no more than they had always been (see Chapter 8). The difference as compared with, say, 1905, was that there were now many more relatively large and powerful competitors. Thus although

Triumph was still the largest firm with the biggest reputation, its product was losing that relative advantage in performance that had first enabled it to gain its pre-eminent position. In 1913 the firm's profits, having risen from £22,048 in 1908 to £69,950 in 1912, showed the first decline since 1904, though down only to £68,100.⁵ This would seem to have been only a temporary reversal in Triumph's expansion since profits were up to a new record in 1914 of £74,393,⁶ although War Office orders on behalf of the armed services probably accounted for at least part of the increase.

But while Triumph continued to do well commercially, new developments were taking place in the industry which threatened to leave it behind. Technical progress was going far beyond the wider adoption of variable speed gears, and much more exciting machines than Triumph's 3½hp model were being developed. Some of these were bound to influence the industry as a whole but would they be important enough to divert motor cycle development into entirely new directions?

New Directions?

Of the newer designs, some were rather exotic, and radical in conception, others less so. The degree to which the new ideas they represented were likely to be more widely adopted, depended on how easily they could be incorporated into models not too far removed from the standard pattern.

Of the more radically innovative designs, the Scott almost certainly did have influence elsewhere, and this will be considered later. The new model James, despite its advanced technology, was rejected and had little or no immediate influence on contemporary developments. What was probably the most unlikely design of the whole period was the TAC, but it did survive from 1909 until 1916 and so it deserves examination.

The TAC (touring auto-cycle, later called the TMC, touring motor cycle), was the product of the Wilkinson

Sword Company. As can be seen from fig.10.1, it was a very unusual motor cycle and quite unconventional in design and appearance but extremely well equipped. It had a four-cylinder engine, shaft drive, a three-speed gear box, and a car-type bucket seat, the very ultimate in motorcycling luxury.⁷ It cost £68 when first introduced, which was rather more expensive than the ordinary motor cycle but, given its rather advanced specification, it was probably good value for money.

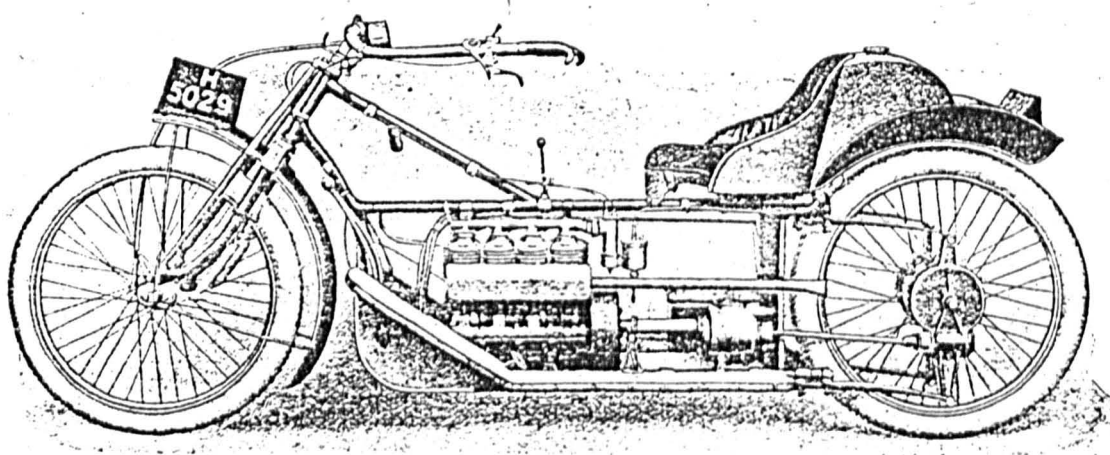


Fig. 10.1. The Wilkinson TAC
("The Motor Cycle", 6 December 1909)

The TAC survived rather longer than might have been expected for such an unusual machine, but it is doubtful if it had any effect on contemporary design. From the point of view of rider comfort and luxury, it represents a concept, which is revived from time to time but without ever having much impact.

Of rather more significance for the industry as a whole, were developments which concerned more conventional designs or which might be incorporated within the standard design format, but still went far beyond the single cylinder Triumph type machine. Triumph had done most to establish in the public mind what a motor cycle should look like, but this did not preclude the development of more innovative designs within the same general framework. A

machine could be very like the Triumph in terms of frame, wheels, handle-bars, saddle, transmission, lubrication system, ignition, brakes, controls, and many other smaller details, and yet with a different type of engine, it could be a very different kind of motor cycle. It was with the development of new types of engine and the improvement of older ones, that the most significant changes in the industry's overall product structure began to occur. Following the racing successes of Matchless and others with V-twin engine models, Douglas with horizontally-opposed twins, and Scott with water-cooled, two-stroke twins, producers began to turn with increasing interest to similar types of engines.

The twin-cylinder engine for motor cycles was not a new idea. V-twins had been developed in the 1890s for car use, and motor cycles equipped with such engines had first become available about 1903. The single cylinder engine, however, had remained by far the most popular for its simplicity, light weight, good performance and relative cheapness. But twins had definite advantages and not just in the greater power of the bigger engines, but also in the smoothness of this type of engine in general. They sometimes seemed to lag in performance, however, compared with single cylinder machines, and in the 1907 TT the latter were faster than the twins. But this was soon to change.

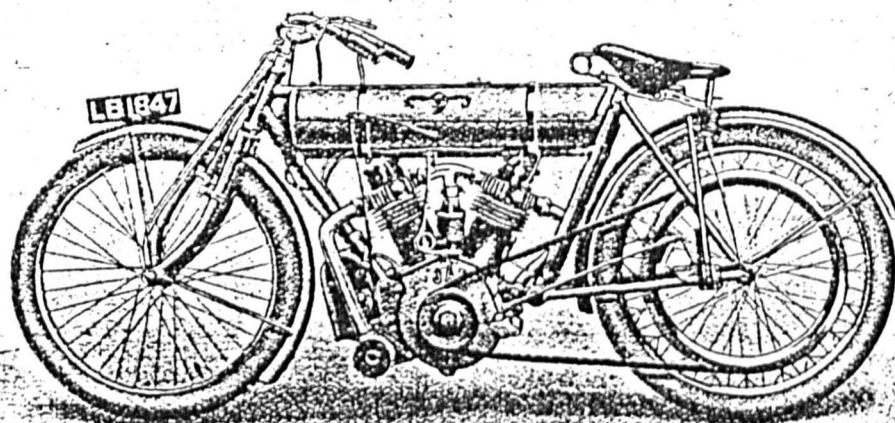
In 1909 and 1910 the Matchless V-twins (fig. 10.2) won the Senior TT, in 1911 the American-made Indian V-twins took the first three places in the same race, and in 1912 and 1913 the winner was the Scott. Humber meanwhile had won the 1911 Junior TT, Douglas won it in 1912 and NUT in 1913, all with twin-cylinder machines. As illustrated by the success of Douglas, Scott and others, a TT win was the best possible advertisement (see page 208) and must have increased interest in similar machines. A good indication of this is the increase in the proportion of twins exhibited at the Olympia Show, up from 34% of all motor cycles in 1912 to 41% in 1913.⁸

Another reason for the increasing use of twin cylinder

The Famous "MATCHLESS" Motors

FAR AHEAD OF ALL OTHERS.

International Tourist Trophy { 1st in 1907
2nd in 1908
1st in 1909 } Against all comers.



Gold Medals for Reliability—End to End—London to Edinburgh.

Hill Climbs—Snaefell, I. of M. 15 secs. faster than all others.

Amulree Hill Climb, 4 firsts, 1 second. Etc., etc.

Hold more recognised World's Records than all others combined.

Models from 2½ h.p. to 9 h.p.

May we send you our latest catalogue of Britain's Best Motor Cycle.

H. COLLIER & SONS, LTD., Herbert Road, Plumstead, S.E.

Telephone—232 Woolwich.

Telegrams—"Matchless, Woolwich."

Fig. 10.2. Matchless Advertisement
("The Motor Cycle", 27 December 1909)

machines, and particularly the bigger ones, was the growing popularity of motor cycle-sidecar combinations. One firm, Clyno, claimed that their machine was the first to be developed exclusively for sidecar use,⁹ and, as we have seen, their effort was fully repaid when the war began as they became the main suppliers to the War Office of motor cycle combinations.

The vast majority of twin-engine machines still had V-twin engines, but now a new kind of twin began to achieve a degree of popularity. Of the TT winners, the success of the Douglas particularly resulted in an effort on the part of other manufacturers to develop an imitative model. The horizontally-opposed engine, more easily referred to as "the flat twin", apart from having a rather good performance, was seen to have various other advantages: "It is a feature of the flat twin engines that they seldom gum up.

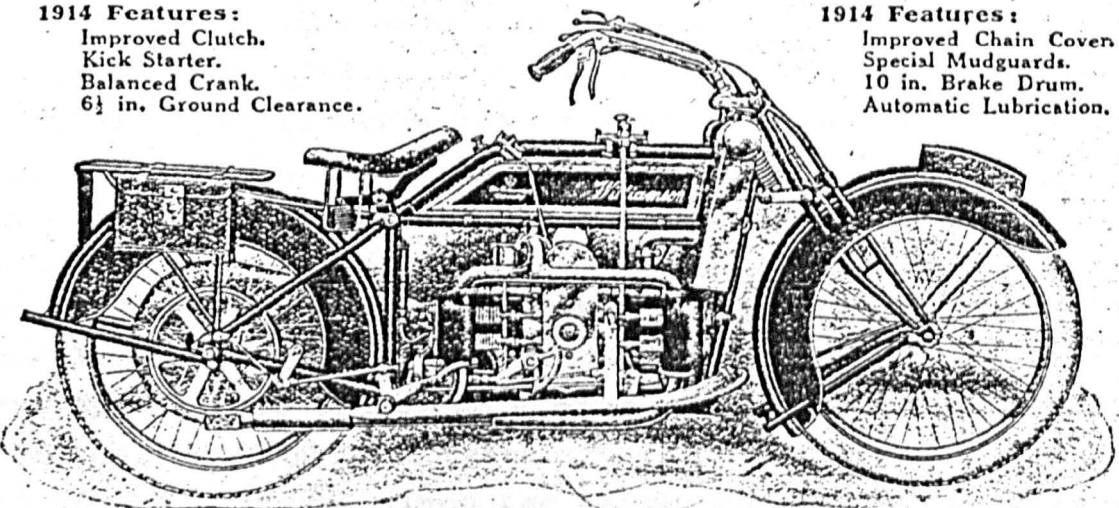
They are the easiest of starters, wonderfully flexible and efficient, and undoubtedly a good deal of this is due to the outside flywheel and its large diameter rendered possible by reason of the fact that it is outside the crank case. Their perfectly even firing is well knownwhilst the mechanical balance is as good as can be with a twin".¹⁰

One of the most interesting of the new flat twins was the ABC, which was equipped with overhead valves, a four-speed countershaft gear box and chain drive. In 1914 it set the first world speed record by a streamlined motor cycle at 80.47mph for the flying kilometre.¹¹ Other models came from firms such as Brough, and Williamson. Williamson may possibly have had some kind of family connection with Douglas,¹² since its 8hp water-cooled engine and gear box were supplied by that firm. It, like Clyno, advertised its machine (fig.10.3) as being "The only motorcycle yet

8 H.P. WATER-COOLED 1914

WILLIAMSON

1914 Features:
 Improved Clutch.
 Kick Starter.
 Balanced Crank.
 6½ in. Ground Clearance.



1914 Features:
 Improved Chain Cover
 Special Mudguards.
 10 in. Brake Drum.
 Automatic Lubrication.

The only motorcycle yet designed, manufactured and sold as a passenger-carrying vehicle.
 8 h.p. water-cooled Douglas engine, and Douglas gear box. Can carry from one to five.
 Quieter than a car, easier to drive, cannot get the knock.

THE WILLIAMSON MOTOR CO., LTD., ————— COVENTRY.

Fig. 10.3. Williamson Advertisement
 ("Motor Cycling", 16 December 1913)

designed, manufactured and sold as a passenger-carrying vehicle".¹³ Whether or not the claim was strictly true, this kind of advertising obviously paid since the firm was later reported to have as much business as it could cope with.¹⁴

By November 1916 just before the government suspended civilian motor cycle production, there were thirteen different flat twin models on offer to the public,¹⁵ when only three or four years previously the Douglas had been the only one.

No one attempted to imitate the Scott possibly because it was too original a design and the technology employed was too different from established practice. It was also rather expensive which may explain why it sold only in the hundreds while the Douglas rapidly achieved sales in the thousands. But its success must have encouraged and reinforced the development of three distinct trends which ran counter to the standard single cylinder machine: twin cylinder engines which have already been discussed, two-stroke engines, and water-cooling.

Of these, water-cooling, despite the increased interest being shown in it by firms such as Rex, Williamson and Humber, gained only a relatively limited following at this time and, probably because of its cost, was likely to be offered as an extra rather than as standard equipment as, for example, in the 3½hp Humber.

The two-stroke engine was quite another matter, however, and did, by the early war years, achieve considerable popularity. "The Motor Cycle" Buyers' Guide for 1913 models listed only six machines with two-stroke engines,¹⁶ but by the 1915 issue the number had risen to 75.¹⁷ This was the most important change in the overall product make-up of the industry since the emergence of the new Werner type in 1901, but it represented less a challenge to older standard types such as the Triumph, which would retain their popularity, than the development of an entirely new product class, the lightweight motor cycle.

Motorcyclists had been calling for lighter machines

ever since the earliest days of the motor cycle. Many riders, and particularly former cyclists as most motor-cyclists were, found even the earlier motor cycles rather too heavy and cumbersome for comfort. For a long time, however, little progress was made and, as was noted in Chapter 8 (page 163) early lightweights were not considered particularly good. More machines of better quality had been produced by 1907, but they still represented only a rather small proportion of the total number of different models on offer.

Perhaps up to that time when most motor cycles were still rather uncomplicated and consequently not particularly heavy, there was not really any great need for lighter machines. But each new technical development ultimately meant an increase in weight: bigger and more powerful engines were themselves heavier and required stronger and heavier frames, improved weather protection and better equipment all round, all resulted in heavier machines. The two-chain transmission system with countershaft gears, which would eventually become the universal standard, could alone add from 20 to 60lbs to total weight.¹⁸

In "The Motor Cycle" Buyers' Guide for 1908, there were only two machines which weighed over 200lbs.¹⁹ By 1913 the number had increased to 39.²⁰ Some of this increase was accounted for by the introduction of bigger, more powerful machines but not all of it. The standard 3½hp Triumph itself increased in weight by 20lb from 1908 to 1912.²¹ Thus now the need for lighter machines was all the more pressing.

The development of the two-stroke engine proved to be a major step in this direction. The two-stroke was not a new idea. It had been invented back in 1880 by Dugald Clerk, and was first developed for motor cycle use in earlier years but without any great success until Scott's machine was put on the market. The Scott was no lightweight but attracted attention to the two-stroke and other manufacturers began to develop their own versions, not in imitation of Scott's water-cooled twin, but in much simpler

form as air-cooled, single cylinder machines.

The two-stroke was the ideal engine for the light-weight machine because of its simplicity. The inlet and exhaust ports were so placed in the cylinder that they would be opened and closed by the passage of the piston. Thus there was no need for valves and the complicated valve mechanism of the four-stroke engine could be dispensed with altogether. This made for a very light engine with a minimum of moving parts which would not only be relatively simple to manufacture and maintain but also cheap. One of the pioneers of this type of machine was Hughes Butterfield Bros., manufacturers of the Levis.

Hughes Butterfield had been carrying out experiments on two-stroke engines since 1908, but did not produce a marketable machine until 1911. It was then they entered the industry with three models, two classed as $2\frac{1}{4}$ hp (211cc) and one of $2\frac{1}{2}$ hp (269cc). The cheapest (fig. 10.4) was priced at £33.12s compared with about £50 for the typical $3\frac{1}{2}$ hp Triumph type machine. Its weight was only 85lbs against 180lbs for the Triumph. Levis motor cycles were an immediate success.²²

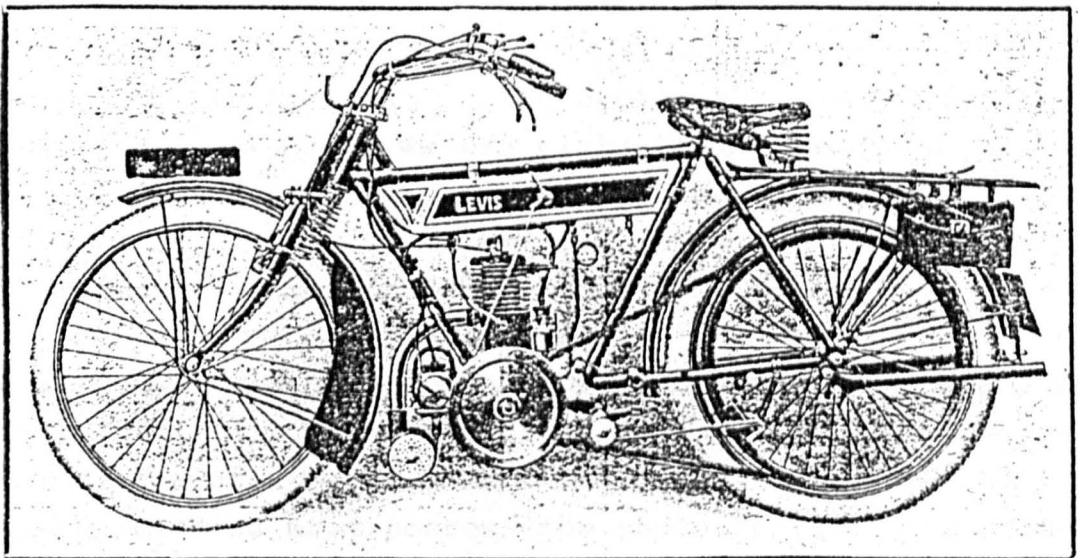


Fig. 10.4. The Levis $2\frac{1}{4}$ hp Two-Stroke
("Motor Cycling", 21 November 1911)

By the end of 1913 the new trend was apparent: "Perhaps the greatest tendency of all in the design of motorcycles is towards the ultra lightweight or motorcyclette, as we have termed it. This is very gratifying to us, for we have devoted considerable space in the past to explaining that feather-weight machines which are exceedingly cheap to purchase and run and simple to manage will have enormous sales. Our appeals in this direction have met with universal approval, and manufacturers who first scoffed at the idea of producing motorcyclettes are now busy designing them".²³

Soon even Triumph had introduced a two-stroke lightweight, a 2½hp with two-speed countershaft gear-box. It weighed 125lb and was priced at £42, rather more expensive than many of the new lightweights, but it was of more advanced specification. This was Triumph's first departure from their long-established standard machine, and it created a considerable amount of interest. In answer to the question, why had they adopted two-stroke practice for their lightweight, the answer was: "We understand it is solely by reason of the great simplicity of this type and the very few moving parts, so that there is, to all intents and purposes, nothing to go wrong. Taking it altogether, this machine is brimful of novelties, a number of patents having been applied for in connection with same, and as a final word, we think we are right in predicting that this machine will appeal to a very large riding public, particularly as it will be so useful and suitable for town use".²⁴ The commuter motor cycle was born.

For all this substantial new development of lightweight machines powered by two-stroke engines, there was little deviation from the wider standard and the maintenance of the standard pattern was expected and called for: "such a machine must possess the characteristics of reasonable power development, ease of handling, and a general capacity for work; in short, it must still be a motor bicycle ipso facto, and incorporate in its design, all the outward and visible signs of conforming to a standardized

principle of construction".²⁵ Thus the standard motor cycle might evolve radically in some respects, but in its overall pattern it was likely to remain much as before.

The Machine of the Future

Apart from the development of the two-stroke and the flat twin, the period 1908-1916 was largely one of consolidation of standard types. There were many improvements, however. The typical motor cycle of 1914 was far less likely to have pedals than in 1908 (down from 75% to 32%), and far more likely to have chain transmission (up from 4% to 34%) and a form of variable gears (up from 29% to 79%). The kickstarter, almost unknown in 1908, was almost universal by 1914 except for high-powered machines.²⁶ The same period saw also the gradual abandonment of battery and coil ignition in favour of the magneto, improved layouts for controls, increasing attention to weather protection for different parts of the machine with improved forms of chainguards and mudguards, better brakes with increasing interest being shown in the internal expanding type which would eventually become universal, and the beginnings of electric lighting.

One of the most advanced motor cycles of the period was the American-made "all electric" Indian (Hendee Co.) (fig. 10.5), introduced in 1913. At this time the typical machine of up-to-date specification was equipped with magneto ignition which dispensed with the need for batteries, acetylene for lighting, and the recently introduced kickstarter. The new Indian promised to change all that. It was equipped with two batteries, a dynamo to charge the batteries, all-electric lighting, and an electric starter.²⁷

The electric starter had only been introduced a year or two previously for cars, and it was extremely advanced for motor cycles which always lagged several years behind car technology because of weight and cost. As it turned out the new model was premature. Motorcyclists were not yet ready for electric starters and it was another fifty

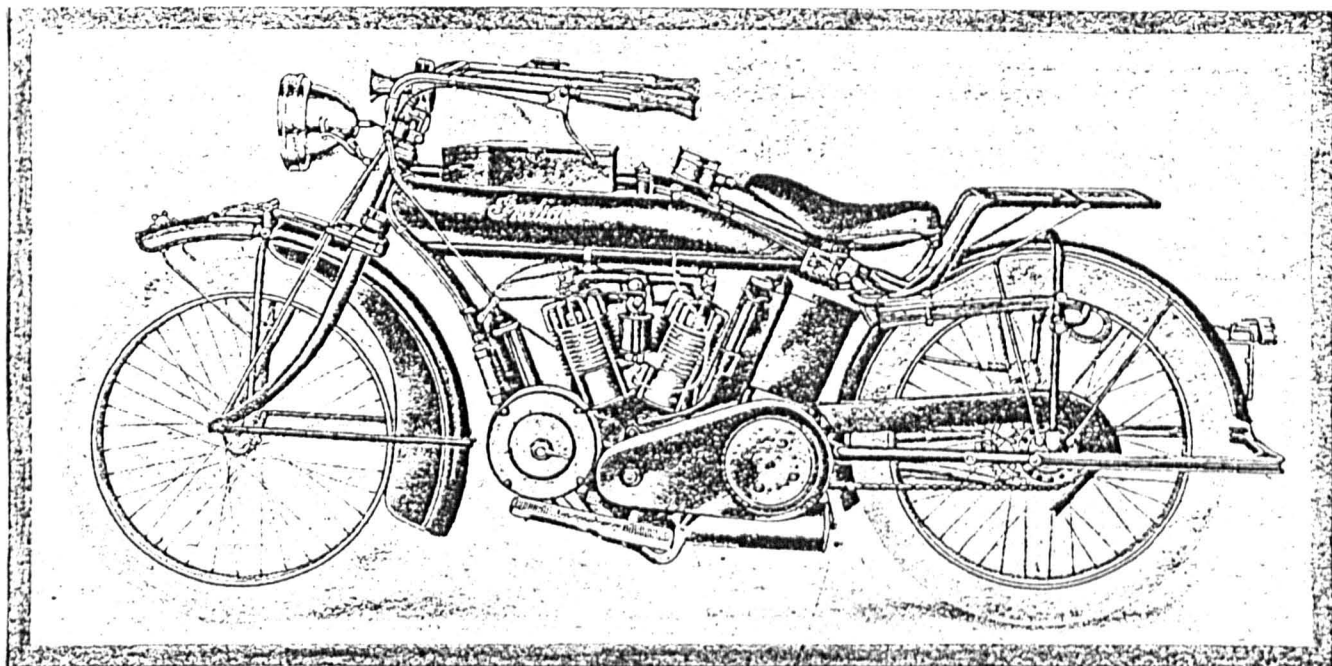


Fig. 10. 5. The "All-Electric" Indian
("The Motor Cycle", 6 November 1913)

years before they were adopted for motor cycles to any significant extent.

Another machine which was ahead of its time was the ASL (Air Springs Ltd.) (fig. 10.6), introduced about 1909 and equipped with air springs both for the front forks and the frame. Air springs had been developed for bicycles

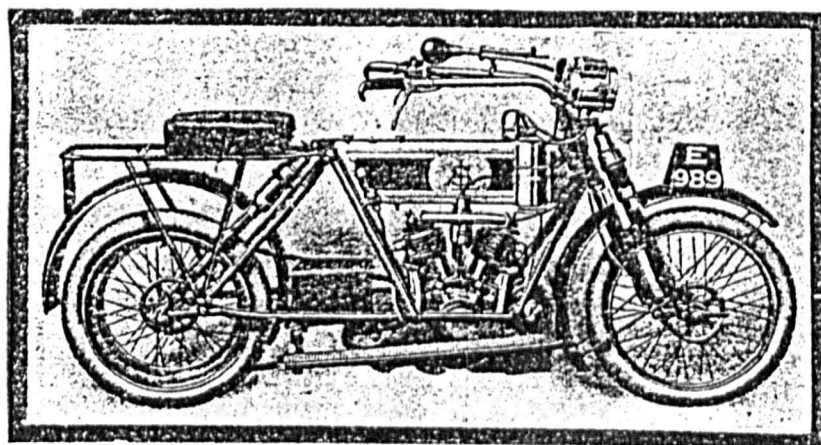


Fig. 10.6. The ASL equipped with Air Springs
("Motor Cycling", 4 April 1910)

several years before, but most motor cycles still had rigid frames and on many the latter were retained until after the second world war. The idea therefore was extremely advanced for a motor cycle and put the ASL in the same category of innovativeness as the Indian. The machine was innovative also in its small wheels and the padded seat, rather suggestive of modern practice, which replaced the more typical saddle,²⁸ but it did not achieve any great popularity and there were no imitators. Production ceased in 1915 and was not resumed after the war.

Many other innovative and highly unusual machines were developed in this period, some of which went into production while others did not progress beyond the prototype stage. The former included the Wooler two-stroke, the Pearson Cox steam motor bicycle, and the Wall auto-wheel which could convert any bicycle into a powered tricycle. Of the prototypes which did not go into production, the most interesting, both developed in 1913, were the Humber three cylinder flat twin which was described as "quite different to anything we have yet seen",²⁹ and certainly one of the most original of engine designs, and the Triumph parallel twin. More than twenty years later, Triumph was to regain its long lost technical leadership of the industry with such a model.

. Thus for all the trend to standardization, there was no lack of experiment and development of some highly innovative technologies. This sometimes led to the brief, and often not so brief, appearance on the market of extremely innovative motor cycles, but it could neither halt nor reverse the trend. Most of the new ideas, if they were good and fairly cheap and not too complicated to apply, were eventually incorporated into the standard types of machine. Other ideas were often shelved for ten, twenty or even fifty years, before being revived, applied, sometimes achieving widespread adoption. Almost all the significant developments in motor cycle technology of later years had been thought of by 1914.³⁰

Conclusions

After four years of technical leadership, Triumph had, by 1908, developed the machine that was soon to be recognised as the industry standard. After another four years they had clearly lost that leadership and it was no longer possible to identify a single firm as the leader. This was the result of two factors: Triumph's tendency to conservatism, and the growth of the industry, so that now, by 1912, there were several firms which needed to compete with Triumph by innovation and not simply by imitation.

Technically, Triumph fell behind mainly as a result of the firm's slow adoption of variable gears. When at last it did adopt a system of variable gears, it was of the hub type which was effective but soon to be replaced by the superior countershaft type.

This did not mean that Triumph's standard type of motor cycle was superseded; it was simply improved. A standard model can never be a static design; it must evolve constantly as new ideas are developed and incorporated within it.

But although the big single-cylinder machine remained the most popular model, other types of motor cycle were achieving an increasing share of the market. Twin-cylinder machines were gaining in popularity and so were light-weights. Apart from their engines, however, most of these remained much like the standard single-cylinder machine. Thus the Douglas, which by 1914 had achieved an output to rival that of Triumph, was, apart from its engine, very much a machine of standard design. In time the twin-cylinder machine might supersede the single, and the light-weight would develop into a distinct product class in the form of today's commuter machine, but not yet.

Many radically new ideas were developed during the period covered by this chapter but few of them gained any immediate acceptance. Some gained a small following, others had to wait many years before achieving any popularity, and some ideas still have to be applied.

The Scott was the unique machine, the exception that

proved the rule that consumers in general are reluctant to adopt the radically new product. It succeeded only because it was outstanding and was demonstrated to be so. Other highly innovative machines that lacked the competition success of the Scott were rejected, or survived but only as small-firm products with limited output.

Thus it was the standard machine that prevailed and new ideas that could not be incorporated within it were almost invariably set aside. Ultimately it was the consumer who dictated this policy. Was he really so satisfied with the standard machine? This is the subject of the next chapter.

CHAPTER 11

STANDARDIZATION, 1908-1916 (3): THE MOTOR CYCLE AS CONSUMER PRODUCT

This chapter once more examines the motor cycle from the consumer point of view. It considers not just the vastly improved standard machine, but also how much more the new types of machine had to offer.

Introduction

During this period the motor cycle became for the first time a product that was no longer to be treated with suspicion. Its potential was widely recognised and its popularity grew rapidly. In 1910 a writer concluded: "There can be no longer any doubt that the motor-cycle has come to stay." Among the reasons he gave for this conclusion, were the greatly increased demand for motor cycles, and the fact that "it is no longer necessary for a man when setting out on a journey to take with him practically a duplicate of every moving part of his engine, as it was in the old days. The only spare parts one should carry nowadays are limited to valves, sparking plugs, and belt fasteners". Also noted, were improved performance and improvements in design which allowed greater comfort and safety to the rider.¹

Clearly by now motor cycles were much better than they had been even a few years before, but let us evaluate them not solely in terms of the comments of one writer, but from the point of view of actual road performance as reported at the time.

The Machine on the Road

In writing about "A Trial of a Twin Rex", BHD discusses the meaning of the word "trial" and in the process gives us an idea of how attitudes to motor cycle

performance had changed over the years following improvements in the machine itself:

"Trial" is a word of ever-changing meaning to the motor cyclist. Time was when it meant to me a cautious gambol round Hyde Park previous to a rash purchase. Then the hill-climbing bugbear loomed larger, and I felt no trial was complete that did not include the ascent of Westerham. Then racing theory infected me, and my trials took the form of an early morning run at double legal limit, and as prolonged as might be. Then, again, I learnt with some machines to use the word trial in a purely scriptural sense; it is a very real trial to travel even a few miles on some machines. But today, when practically every machine is speedy, a good hill-climber and reliable, "trial" has been narrowed down in meaning, till for me it scarcely includes more than tests of comfort, control, and especially FLEXIBILITY (capitals please), the old trio of desiderata—reliability, speed, and hill-climbing—being taken for granted.²

The machine did, indeed, prove to be well up to expectations in terms of reliability, speed and hill-climbing, but was lacking in comfort which was "frankly disappointing, as the springs of the front fork were decidedly too stiff for my weight, and, in addition, when Nature designed my legs, she had not foreseen that I should ever ride a 20in. frame. I felt in momentary danger of being forced out over the back mudguard by the heavy wind pressure whenever I let the machine out; however, it is well understood that this is the speed merchant's Rex. He who would potter in comfort is meant to ride the heavier mount with the cantilever seat.³ Control, however, was found to be "admirable" and flexibility particularly good, with the machine capable of being "slowed right down to balancing point" and then accelerated smoothly away up to high speed.

But what of the popular standard, the Triumph and similar machines produced by other manufacturers? A road test of a 1909 3½hp Bradbury proved it to be of good speed and "we never found a hill it could not climb".⁴ A similar

machine road tested the following year, was the 3½hp Brown which was "a real flier—there were few other than T.T. machines that could show her a lead anywhere" and "she simply romped up all the hills we put her at".⁵

Another Triumph type machine was produced by the Rover Company which had left the industry in 1906 and only just returned. The new model was said to have taken only six weeks to develop from drawing board to finished article,⁶ which indicates just how easy it was to produce an effective motor cycle after some one else had shown the way. The new machine proved a good performer, it had good speed, did well on hills and was praised for its control layout, and all this despite a rather conservative specification.

The real leader at this time, however, was the Triumph, and its most effective testers were not specialists employed by the press but intentional record breakers. If we ignore the Triumph's John o' Groat's-Land's End records of 1909 and 1911, and its TT win of 1908, then two performances stand out, those of Albert Catt and Harry Long.

In Chapter 8 an account was given of BHD's performance in riding a Triumph two hundred miles a day for six consecutive days. In 1910 Albert Catt set a new record by riding three hundred miles a day for five days, falling short by just over 50 miles on the sixth day because of technical trouble. The total mileage was 1,882 and the machine was again a Triumph.⁷ But Catt was not satisfied with this, particularly when he heard that others were planning to break his record, and so only six months later he set out to improve it by raising the daily mileage to four hundred "and thus put the record fairly safe".⁸

The first day's run was from Northampton to London and then on to Edinburgh, a distance of 461 miles. Catt set off at 12.30am and had covered only 33 miles when, at 2am the first mishap occurred, a puncture caused by a piece of glass. Punctures were very much the story of the day, and no less than eight had occurred before Edinburgh was

reached after $22\frac{1}{4}$ hours on the road. There were several other minor problems including running out of petrol miles away from the nearest source of supply, a problem with an exhaust valve which was soon put right, a period of heavy rain and a wrong turning which added a mile or two to the journey. These did not deter our hero, however, who set off again the next morning at 3.20am.

That day—Edinburgh to London—"At Berwick-on-Tweed the roads were so shockingly greasy and there were so many people going to work that I was obliged to walk over the bridge".⁹ Despite several more punctures, the main problem of the second day was the belt which, after being shortened twice, broke and then broke again, the second time flying off to disappear into the grass by the roadside. The problem of the exhaust valve also recurred but the run was completed, nevertheless, and despite 300 miles of rain.

The third day—London to Exeter and back and then on to Northampton—"It was a miserable, damp morning, and



Fig. 11.1. Albert Catt
("The Motor Cycle",
18 May 1911)

bitterly cold. When I reached Bagshot I had to dismount and run beside the machine to restore circulation.....The roads got very bad towards Exeter; they were all pot-holes and greasy.....several miles out of Exeter.....a car came whizzing round a corner at a terrific speed, and missed me by a small margin.....I arrived at the Marble Arch at 7.18 p.m., where I checked and had tea. I was in an awful state and wet through, and nearly done up. A hasty tea and I was soon on my way again.

It did not stop to rain in places, it simply fell down, and on my arrival at St.Albans I was obliged to shorten the belt again to get up the hill going into that town".¹⁰

These belt problems were typically caused by rain and

if the weather had not been so wet would very likely not have occurred at all. The day's run was completed at 11.5pm.

By now the exhaustion of the rider was probably a more significant factor than the endurance of the machine. When he was called at 3.30am on the morning of the fourth day—Northampton to Holyhead and back—Catt refused to get up and would not listen to the requests of his friends (Triumph agents?) to make a start until an hour later. This was a better day, however, as the rain had stopped and there were no belt troubles, but there were two more punctures. The run was completed at 11.10pm.

The fifth day—a circuitous route from Northampton to Southampton and back—was also without too many problems: just one puncture, a stop to shorten the belt and another to clean the plug when the machine suddenly stopped in the middle of Oxford. Again the run was completed after 11pm.

For the sixth day, again starting and finishing in Northampton, no punctures or technical problems were reported. At Royston, while waiting for some friends who were going to accompany him the rest of the way, Catt reported: "On dismounting I found that I could hardly stand, the vibration from the footrests had made my feet swell so much. My friends soon got going, and accompanied me about twenty-five miles, when I suddenly found they were missing. I felt too tired and exhausted to wait about for them, so I continued".¹¹ Thus Catt finished alone, arriving in Northampton at 10pm to be met by the Mayor, members of the Corporation "and thousands of enthusiastic folks".

Catt's achievement demonstrated what by now hardly needed to be demonstrated, that the Triumph was an extremely reliable machine. There was little mechanical trouble but many punctures, an exceptional number for the first two days, but hardly a day went by without at least one. Against this, there had been no punctures six months previously during Catt's first effort, so it would seem that some tyres even of the same make were better than others. The belt problems—the belt broke five times in

the first three days—were caused largely by the rain, and this was one of the major reasons why the belt had eventually to be replaced by the chain. Clearly there was still much room for improvement in the standard machine.

Harry Long's rides were quite a different matter since they extended over ten months and covered 40,000 miles. Long was the kind of man who, had he been alive today, would make getting his name into the Guinness Book of Records his sole ambition. In 1909 he covered 12,000 miles on a pedal bicycle, in 1910 he increased this to 25,000, and in 1911 he set out to do something similar on a motor cycle. Unlike Catt, he had no previous motorcycling experience, and took his first ride on a motor cycle on 4th January at the Triumph works. After a few days instruction he set out on his journeys. This time, however, there were no frantic efforts to get from one place to another as quickly as possible. The rider took his time, travelled only during daylight hours at a modest pace, averaging about a thousand miles a week. What was required of the rider was not a high degree of riding skill nor the kind of physical endurance displayed by Catt, but patience and perseverance.

The machine also was reported to have performed well: "Practically no mechanical troubles have befallen him, and the ride is an extraordinary tribute to the soundness and reliability of the modern machine".¹² The wear and tear on the Triumph, however, was much greater than suggested here and in addition to the periodic removal of carbon deposits from the engine (about every 2,000-3,000 miles), many repairs were needed as detailed in Table 11.1.

Apart from these repairs, five back and three front tyres were worn out and had to be replaced together with thirteen belts and three sparking plugs, all of which added up to a very considerable amount of work, and as a correspondent of "Motor Cycling" suggested: "all we have left of the original machine are the tank, frame, cylinder and crankcase".¹⁴ Thus the endurance of even the best machines was still rather suspect.

mileage	work done
8,208	clutch overhauled
15,752	engine overhauled; connecting rod rebushed; new crank pin; magneto overhauled; new platinum points; new carburettor body complete
22,068	clutch overhauled
23,939	new spokes fitted to back wheel; new throttle piston
28,431	new piston; new tappet guides
30,662	engine overhauled; new crank pin; connecting rod; one ring; new back mudguard and carrier; new front guard
32,000	replaced pulley side ball race (ball broken); new inlet cam (broken at shaft)
35,756	new flywheel spindle and cone; new fork crown spindle and cones; new throttle piston

Table 11.1. Repairs to Harry Long's Triumph¹³

Some correspondents thought the whole enterprise a waste of time which proved little,¹⁵ but it did demonstrate the relative ease of riding a motor cycle great distances as compared with earlier days, and even for a novice although few novices would have had the support of the Triumph factory. It was also wonderful publicity for Triumph and there is no doubt that it paid to support such "epic" rides.

After these two exploits by Triumph riders, the performances of other machines might sound rather anticlimactic, but in fact by 1911 there were probably a number of machines at least as good as the Triumph and its imitations. The Scott was more than a match for the Triumph and demonstrated that it was not necessary to imitate Triumph in order to produce a good motor cycle.

The 1910 Scott was rated at 3½hp, the same as the Triumph, but that was about the only way in which the two

machines were similar. The Scott was a water-cooled, two-stroke twin, had an open frame of Scott's own design, and was also equipped with the kick-starter which had originated with this machine, and a two-speed gear. Every one of these features contributed to the Scott's convenience and performance from a consumer point of view and was never a matter of technology run riot as sometimes seems to be the case with modern products.

One tester was particularly impressed by the engine: "As regards its running, it may be compared to four-cylinder machines, the two-cylinder two-stroke engine being equivalent in torque to the four-cylinder four stroke type. This is saying a great deal, for everyone knows there is only a negligible amount of vibration with four-cylinder engines. This even impulse of the two-stroke Scott motor accounts in a great measure for the longevity of the tyres and the success of the chain transmission. Never have we experienced such comfort from a positive method of transmission, and what is more, the Renold chains have never given a moment's trouble, and have only required shortening once in 700 miles".¹⁶

Another tester who was more concerned with the riding itself, was no less complimentary: "The sensations of driving these machines are quite unlike those experienced on any other type of motor-bicycle. It is more like driving a very heavy and comfortable pedal bicycle propelled by invisible power.....I thought I should like to try starting from a standstill on the 1 in 6 gradient, so I turned round, kicked at the lever, took my seat, and gently engaged the gear, being careful to open up the throttle and advance the ignition at the same time. The Scott purred up without a murmur, and when over the steepest bit took the high speed in her stride. So pleased was I that I decided to have another go, with the result that the engine took hold at the start with such avidity that I only escaped a gate by the skin of my teeth.....Round the corners, up the hills, and along the level we flew, and I could not help being much impressed by the way the machine held the road.

There was no leaping off the ground or bouncing of the wheels, but it was always that steady, even glide, with the smooth hum of the two-stroke beneath. This is largely accounted for by the distribution of weight on the Scott".¹⁷

There were one or two minor criticisms of the machine, including the placing of some of the controls, but this was only the second year of production and such problems could easily be put right.

The Scott was of much the same weight and size as the Triumph; the Douglas was a lightweight in comparison but no less significant in its way.

The Douglas, a horizontally-opposed twin, was, like many of the newer machines, very easy to start. Although it was equipped with a starting handle, the tester found it to be "quite sufficient to engage the low gear when seated, and to waddle with the feet until enough momentum was obtained to jerk the engine over compression, when the little twin would start away with extraordinary ease".¹⁸

Gear changing also was found to be "extraordinarily simple" and traffic riding no problem: "traffic riding, even in the midst of London, presents no terrors, for when on top speed (5½—1) one can travel at six miles an hour by judiciously retarding the spark and throttling down. On the low gear one can move absolutely at a crawl.....Driving through High Wycombe with its crowded streets was a perfect treat on the Douglas. With petrol cocks closed, spark retarded, and only a whiff of gas the little vibrationless twin was just turning over and firing on each cylinder with perfect regularity. There was no hit and miss, no horrid conking, simply the same even silky running, which is one of the best features of the horizontally-opposed twin-cylinder engine".¹⁹

The Douglas was the best of the lightweights, but the novice might have preferred a simpler machine. One of these was the 2½hp Veloce which, although tested during adverse weather conditions, also performed well: "On letting in the low gear the machine slid gently away, and

after slight acceleration in went the high [gear] without a suspicion of jerk. As far as power was concerned the low gear need never have been used, but we found it a great blessing in the thick traffic and on the greasy roads..... Through seas of mud we churned our way all morning, and though the particular machine lent us was fitted up in T.T. style with only regulation width guards they were so well arranged that the mud thrown up was not excessive".²⁰

By 1914 there were a number of the new two-stroke lightweights on the market and one of these was the 2½hp Sun Villiers, priced at only £33 for the two-speed model (£26 5s. for the single speed). Despite the weather and poor roads, the machine performed well on test:

Before long the Cowey pointed to 35, and there is little doubt that this speed could have been easily maintained, were it not that caution had to be exercised owing to the wretched potholey, muddy state of the roads. We had not been a quarter of an hour out of Birmingham before the rain came down in fine form, making our journey by no means pleasant, and the wet getting on to the belt caused slipping which did not enable the willing little engine to show, in road speed, the power she was developing. Nevertheless the 18 miles were covered in under 40 minutes, which, all things considered, makes quite a good show for a 2½ h.p. engined machine.....The feature of easy starting, which is common to most two-strokes was present, and much appreciated owing to the state of the roads; it is so much more pleasant to sit astride the machine, arrange one's overcoat or overalls to one's satisfaction, and then start the engine by paddling off, than having to run alongside the machine, give a flying leap in the saddle, with perhaps the front wheel hopping and sliding to its heart's content in the grease.²¹

At the other end of the spectrum there was now an increasing number of heavyweight machines, designed primarily for sidecar use, but also effective for solo riding. One of these was the 5-6hp (750cc) Rudge-Multi which was equipped with a gear that was almost infinitely variable

between specified limits. The machine was so powerful and the gearing so effective that it required little more than a minimal throttle opening for normal solo use,²² and at most half throttle for sidecar use.²³

Another sidecar machine, and one of the most notable, was the 5-6hp Clyno twin. This was tested over 2,000 miles, both ways on the Land's End-John o' Groat's route, during severe winter weather and with an official observer in attendance:

The observer candidly admitted to me at the start that he had no very great opinion of the merits of a sidecar machine, but after four days had elapsed and the machine was still running with monotonous regularity, he changed round completely, and became interested in the various points of merit brought out by the trial. The kick-starter, clutch, and non-skidding properties of the sidecar were commented upon very favourably.....The magneto was painted over with shellac, which effectually prevents any shorting due to rain. As regards the actual ride, the machine ran most consistently, and the journey from Liverpool to John o' Groats and back to Liverpool, a distance of 1065 miles, was accomplished without a single stop or adjustment of any kind, not even an oil-can being used.....We struck some lovely stretches of pure Devonshire mud from 3 ins. to 6 ins. deep, and the way the machine and sidecar ploughed through this drew from the observer the remark that a sidecar must be absolutely skid proof.....I am told that any other motor vehicle on three or four wheels would certainly have skidded badly in numerous instances under the same conditions.²⁴

During the 2,000 miles the chain broke twice and there was one puncture, but no other problems. Petrol consumption averaged 50 miles to the gallon. With such machines the motor cycle combination had arrived at a high degree of excellence, and was now able to supply the kind of passenger-carrying performance hitherto only available to car owners. It had also eliminated the skid, and achieved all this with a degree of economy only available to the

motorcyclist.

Finally, we come to the ladies. Manufacturers were showing considerable interest in ladies' machines in the pre-war years, and the new lightweights were particularly suitable (fig.11.2). A short article, prompted initially

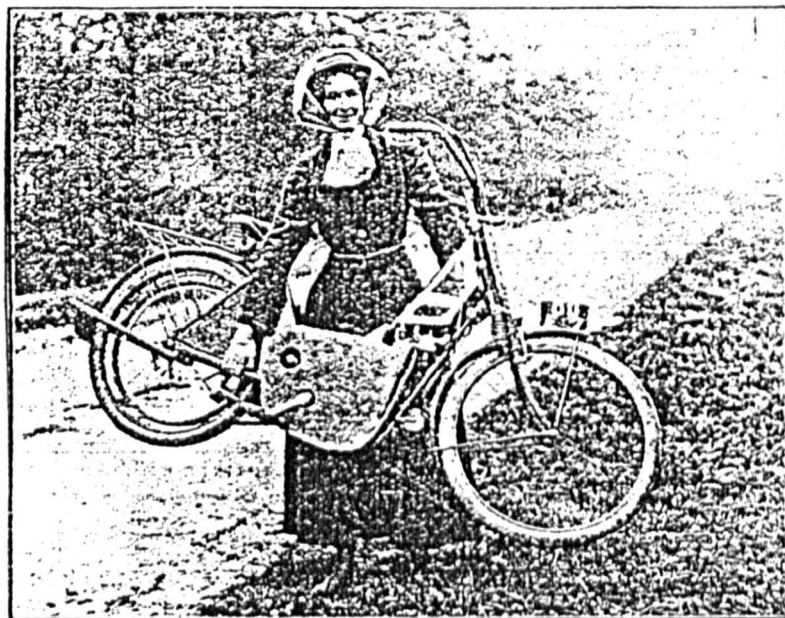


Fig.11.2. Muriel Hind "Tests" a 1½hp Singer Lightweight
("Motor Cycling", 3 January 1911)

The lady, a successful rider in competitions, did test the Singer, but found it rather a "baby" after the fairly heavy machines she usually rode.

by the current interest in running costs, was written by Miss M.K. Bell, the rider of an 2hp O.K. Junior equipped with a two-speed gear. The year's running costs, including about £2 for repairs and spares, came to less than £6 for a total mileage of about 3,000. The most expensive repair amounted to £3 for the replacement of the front forks which showed signs of wear and tear after only a few months. But more interesting than costs and repairs, were the comments which concluded the article:

After a year's experience in all sorts of weathers with my trusty little mount I can affirm that with care and good treatment there is nothing more reliable and

trustworthy than a modern lightweight motorcyclette.

The smallness and lightness of the machine, together with low driving position, make one feel quite safe and "at home" on it very quickly, and the cheery hum with which the small engine tackles and surmounts all hills is very heartening.

No more stuffy trains, with interminable waits at wayside junctions, and, on the other hand, no more back-break and aching legs trundling across country with a heavy head-wind, or a scorching sun, on the old pedal-cycle!

But seat yourself comfortably in the saddle at your own gate, paddle away (one or two pushes-off with the foot are quite enough to set the engine firing), look after two small levers and the gear-changing apparatus, and there you are, nothing more to think of or worry about till you reach your journey's end, be it 10 or 50 miles distant. Why, there is no part of the country, however remote, which need remain inaccessible, "when petrol does the work."²⁵

Clearly by now there was no longer any doubt about the capabilities of the motor cycle in whichever form it was used. Good performance could be expected from all kinds of machine; from the standard type of middleweight which had evolved from the Triumph, but was now equipped with variable speed gears which made it altogether more useful and a good all-rounder; to the low-powered lightweights which were cheap to buy and easy to ride; the ladies' machines which were similar to the latter; and finally the bigger, more powerful machines capable of transporting sidecar and passenger at good speed through the worst conditions. Was this then the end of the road; was the motor cycle at last all it needed to be as far as the consumer was concerned, or was there still something to be desired?

The Consumer: Was He Satisfied?

In Chapter 7 a list was presented of expectations a newcomer to motorcycling might have had of his machine. These expectations were drawn up initially from the point of view of a cyclist turning to powered machines for the first time. As may be judged from the following discussion, these same expectations seem to have been no less appropriate even in 1910 or 1914.

1. It should not be too complicated to understand and control.

As noted in Chapter 8, motor cycles were bound to become more complicated. Complication is an inevitable consequence of the kind of technical development which results in improved performance. Could this have been countered by the increasing technical knowledge of the rider as suggested in Chapter 8? At this stage in the history of the industry, the answer is probably not. In earlier days, only the genuine enthusiast was likely to buy and retain a motor cycle for any length of time. Most motor cycles were so poorly designed that it required a degree of dedication to use them to any great degree.

This situation changed radically with the rapid expansion of the market. As the motor cycle became an increasingly attractive proposition to the consumer, the newcomer to motorcycling must have been more and more the unsophisticated novice, the average person who wanted a motor cycle as a form of regular transport at low cost and involving little additional effort beyond the riding. Neither the traditional motor cycles of the Triumph type nor the new and more sophisticated types that were developed in the years before the war, could measure up to these standards. Both types were inclined to become better performers but at the same time more advanced and more complicated.

The new two-stroke lightweights did answer the problem to a considerable extent, however. Two-stroke engines were much simpler than other types, and lightweight machines in

general were often supplied in the most simplified, basic form so as to reduce weight and minimise cost.

Progress was also being made with regard to controls. Control levers were gradually being moved from various locations to the handle-bars, and the foot gear change, eventually to become universal, had just been introduced. There was still far too much variation in control layouts, however, and this did cause problems. In 1914 there was a widely reported fatal accident, the cause of which was attributed to the rider's new machine which had control levers which worked in the opposite direction to those of his previous machine.²⁶ This was a common design fault in the days before the development of human factors engineering or ergonomics, but although the accident generated a number of calls for the standardization of controls, there was no immediate result.

2. It should start easily and having been started it should keep going until the rider wants it to stop.

In 1908 many machines were still being push started, but this did not appeal to everybody: "many people find great difficulty in getting into the saddle when once they have started the machine".²⁷ The pedal start was becoming equally unsatisfactory since the typical motor cycle now weighed at least 150lb, which made pedalling rather hard work. Easier methods of starting were being introduced, however, particularly for machines equipped with a clutch. These could be started while stationary and, until Scott invented the kick-starter, often had a car-type starting-handle. Scott solved the problem once and for all, however, and by 1914 the kick-starter had become almost universal except in high-powered machines.

Reliability, the ability of the machine to keep going until the rider wants it to stop, is the one factor which makes motor cycles of the post-1907 period stand out from earlier models. Punctures still happened too often, and the occasional breakdown was inevitable as it still is for all types of motor vehicles, but it was no longer to be

anticipated as a matter of course on every journey. Motor cycles were coming to be seen as extremely reliable machines, and this point was often stressed in reports of road tests and long runs.

3. It should have reasonable performance on level ground, let us say, better than a pedal cycle, otherwise there would be no point in the extra expense, and it should go up hills (if possible!).

The comparison with the pedal cycle was by now out-dated, but in other respects this expectation would still have applied and was at last being fully realised for the majority of machines. Performance on level ground was never bad but now it was becoming far beyond the dreams of earlier times. Some manufacturers began to supply certificates of performance with their new machines, and in 1908 the 5hp twin-cylinder Rex was, according to its certificate, capable of 40mph. On test, however, the machine "did that comfortably with the throttle only a quarter open".²⁸ By 1914 many machines were capable of 60mph and in that year an almost standard Norton set a new world record.²⁹ Later in the year Nortons were sold with a certificate indicating that under test the machine had achieved a speed of at least 65mph.³⁰

Performance on hills was even more improved. As variable gears were more widely adopted, it was no longer necessary to buy one of the higher powered machines in order to be certain of getting up a hill. By 1915 only the cheaper machines were still likely to be available in single gear form, and variable gears could be supplied for many of these as an extra.

4. It should handle in traffic, that is, speeds should be variable and brakes should work.

Traffic riding no longer had the terrors for the motorcyclist that had once been the case. Slow riding was now much easier, not only as a result of the improved gearing, but also because the new types of engine tended to

be much more flexible than the older ones.

Brakes also were vastly better. The belt rim brake was now powerful enough to lock the rear wheel if used too harshly, and the internal-expanding brake was slowly being adopted for some of the better machines.

5. It should be reasonably stable and certainly no less so than an unpowered machine.

It was too early to say at the end of our period (and still is) that motor cycle skids were a thing of the past, yet by now machines were far more stable than they had ever been before and skids much less likely. The lower frame, discussed in Chapter 8, was one reason, improved tyres another. A third was the development of spring frames but these were still rare and would remain so for some time.

For people who were afraid of skids but nevertheless wanted to go on motorcycling, there was now available the highly stable and extremely safe motor cycle combination in an advanced and highly efficient form, and many riders did turn to sidecaring for exactly this reason.

6. It should not be too uncomfortable to ride.

The motor cycles of 1912 or 1914 were vastly more comfortable to ride than those of ten years earlier. Lower frames and footboards or footrests in place of pedals, made for a much more comfortable riding position. Spring forks and spring frames when fitted, together with bigger tyres, helped to counter the effects of uneven road surfaces. Vibration could still be a problem, but new engine designs like the Douglas flat twin could reduce it substantially. Improved weather protection in the form of deeper mudguards, and the first signs of interest in leg shields and windscreens promised better things for the future. Yet, as we have seen, the amount of discomfort suffered by the motorcyclist often depended on himself. No motorcyclist was likely to feel at ease after covering four hundred miles in a day, yet for most ordinary purposes few need have had too much cause to grumble.

Summary and Conclusions

If motor cycles still fell short of what they might be, the majority of them were by 1914 able to perform well up to average expectations. Probably by now the deficiency, when a machine failed to meet expectations, was less a matter of potential—the inadequacy of existing technology—than the failure of a particular model or component. A cut-price model which lacked a two-speed gear, could still be expected to have problems on hills. A rider of a machine still equipped with belt transmission rather than chain, as many were in 1914, was almost certain to have problems in wet weather. Such machines could still perform well in favourable conditions, however, and perhaps because of this, rapid adoption of new ideas rarely occurred. So long as older technologies still worked well much of the time and out-of-date models could still made a profit, they were likely to survive.

Another problem was the reliability of components. As Albert Catt might have concluded, he was either exceptionally unlucky in the number of punctures he experienced, or a particular set of tyres, even when obtained from a reliable manufacturer, might still prove to be sub-standard. Problems with poor components were still rather common and might let down the rider on occasion even when he was riding an otherwise high quality machine.

In sum, at the end of twenty years of development, motor cycles were, in the main, easy to start, of good performance in and out of traffic, up hills and down, reasonably safe, and offered a fair degree of comfort for the average rider. If there was a negative side it was not in the lack of improvement but in the slow adoption of new technologies and the raising of expectations from the advance of technology itself. More advanced technology resulted in more complicated machines, but it also indicated how much more might yet be achieved and how much was still sometimes lacking in the machines of the day.

The importance of this analysis of consumer satisfactions rests in the fact that it is the consumer who

ultimately chooses—as a result of his decisions to buy or reject particular products—which machine or model type will become the standard. Once the standard has been established in this way, many consumers will continue to support it since it represents the tried and tested product of known reliability which helps to reduce the risk in the purchase decision. For reasons of this nature the Triumph type continued to sell well and satisfy many consumers even when better machines came onto the market. But from about 1912 its importance began to decline as an increasing number of consumers discovered other types of machine more appropriate to their needs. Thus we may ask, was the trend to standardization at last being reversed? This is discussed in the next chapter.

CHAPTER 12

STANDARDIZATION, 1908-1916 (4): CONCLUSIONS

This chapter concludes the account of the standardization phase. It examines first the relevant propositions of Chapter 4 covering some of the effects of the development of a definitive standard product, and then goes on to summarise the main points of the last three chapters and record the more general conclusions.

The Standard and the Trend

The industry's recognised standard for 1908 and following years was the Triumph. Despite the development of new types of machine such as the lightweight, the two-stroke, and the flat twin, and the further development and increasing popularity of older designs like the V-twin, the Triumph—a 3½hp (500cc) single cylinder four stroke—and its imitations, remained the most popular type of motor cycle until the war.

The establishment of a standard can be looked on as the end product of the standardization process, but as we have seen there was no end to the development of the motor cycle once the standard had been established. Development continued, not just of the standard model but also of new models which might eventually become rivals to it. From about 1912 or 1913 many of the new models offered by the manufacturers were no longer of the Triumph type.

But the trend to standardization continued. New technologies initially created greater diversity but once they had been proved worthwhile many of them were more widely adopted and incorporated into existing standards. New types of product which represented obvious departures from the standard, began eventually to become standardized within their particular class. Thus lightweights, while for ever remaining different in some degree from the middle

and heavyweight machines, became increasingly standardized as lightweights per se. But even allowing for these new types of machine, the first two of the propositions of Chapter 4 are well supported, if not the third:

12. The appearance of a definitive standard will intensify imitation and stimulate research on improving the standard model.

As we have seen throughout the last three chapters, there is no doubt of the high degree of imitation of the Triumph by other manufacturers. As one letter writer commented: "Nearly every other motor bicycle one sees is a copy of the Triumph".¹

This increased development of the standard after a year or two was as inevitable as its widespread imitation in the first place and in fact was probably a result of it. As more firms entered the industry with imitative models, it became increasingly necessary to offer something more than a pure copy; the market became more competitive and there was a greater need to develop and improve the standard. Thus increasing imitation of the standard and increasing competition, made it more and more necessary for firms to divert their developmental efforts towards improving the standard and away from more innovative work.

The most immediate result was that after the rather close copies of some of the earlier imitators like BSA, a growing number of firms began to offer improved models. In 1911 Rudge offered their machine with a vastly better engine, the result of a considerable amount of research. In the following year they offered their "Multi" gear at the same time as New Hudson produced their 3½hp model with a three speed hub gear. By 1912 many firms were offering 3½hp models with hub gears and by 1913 some had gone further by producing models with countershaft gears. There were many other improvements to these standard models but the adoption of variable speed gears was the most important.

Thus the widespread imitation of the standard, far

from leading to anything in the nature of technological stagnation actually stimulated its further development and improvement.

13. As the definitive standard becomes more entrenched, more innovative products will have to be increasingly outstanding in order to compete with it.

It was never easy to compete with the standard even in the earlier days when standards were transient and of relatively low quality, so we should expect it to become even more difficult to compete when the standard was of high quality and firmly established. Against this, development work was now being performed much more effectively so that highly innovative machines nearly always offered something extra and well worthwhile as compared with the standard.

Something extra, however, was rarely enough to ensure commercial success. Many highly innovative machines were developed during this period but few of them succeeded to any great degree. Among the more obvious failures were the James and the first Veloce model. The James was replaced very soon by a more conventional model, while the Veloce remained in production but was sold in such disappointing numbers, that it was supplemented also by a conventional design. Both were very good designs and of rather advanced technology, perhaps too much so, but their advantages were probably not sufficiently visible to the consumer to overcome the normal resistance to the radically new product.

Among the more innovative models that may have done rather better were the ASL, the Wilkinson TAC, the Wooler two-stroke, the Douglas, the Scott and the Williamson. The last three of these did extremely well commercially but there are no production figures relating to the others and they may have sold only in rather small numbers so that they would hardly have been competitive with the standard.

The Douglas, although resembling the standard in general format, was untypical in terms of engine design to the extent that it was laughed at when first exhibited at

the Stanley Show. It did prove to be an outstanding performer, however, and was the only machine to rival the Triumph in terms of production figures. The rather more innovative Scott, the most outstanding new design, was able to match both Triumph and Douglas in popular acclaim and was decidedly a commercial success, but was never able to match them when it came to level of production. As things turned out, it was the only long-term survivor among the more radically new designs of the period. Thus in order to compete with the standard with a radical innovation, it was necessary to offer an increasingly high level of performance.

If it was becoming more difficult to compete with the standard, the chances for an innovative machine which did not compete with it directly but in fact belonged to a different product class, whether lightweight or heavyweight, were rather better. Probably the majority of non-standard machines which succeeded during this period belong in these classes and thus did not have to compete directly with the standard. The proposition would hold therefore despite the successful introduction of such machines as the lightweight Levis and the rather large Williamson.

14. As the definitive standard becomes more sophisticated, it will be easier to compete with it by offering a similar but slightly inferior product at a lower price.

This proposition was prompted by "The Economist" which considered: "A remarkable feature of the boom in the motor-cycle trade has been the large proportion of it which has gone to the small assembling firm, and this is why our imports of foreign parts have gone up. The larger firms take a longer view; they know the boom cannot last, and they will not extend their plant, nor will they reduce the quality of their product to reap big profits while it lasts. As a result the machines which have been sold most profitably are those which can be put together quickly with foreign parts, and have been largely advertised".²

The thinking behind the proposition was that in view

of this observation by "The Economist", we have here a significant step towards the cheaper mass-produced product. The development of a standard product with a wide consumer appeal was the first step. A cheaper form of production of such a standard product would be the second. There are reasons for doubt, however, that such a stage in the industry's development had yet been reached since "The Economist" was substantially in error.

There is no doubt that British imports of motor cycle parts did rise substantially in 1912, to £192,000 from £66,000 the previous year.³ It is not easy to trace the destinations of these parts. There is little indication from the "Motor Cycle Buyers' Guides" for 1912 and 1913,⁴ that they were incorporated into the products of established British firms, the vast majority of which continued to use British made engines, carburettors, etc. If they did go to small assembling firms, the latter were local dealers who were little known and certainly did not advertise nationally on a noticeable scale.

If some of the established firms were not extending their plant because they feared the boom was almost over, several others were expanding quite rapidly, but not in order to produce cheap products assembled from foreign made parts. There is in fact little sign of a reduction in product quality at this stage, and when cheaper products did come onto the market they were in the form of the simpler lightweight, two-stroke machines, which sacrificed little or nothing in quality despite their low price.

The value of imported parts fell to £106,000 in 1913 and £55,000 in 1914,⁵ which indicates that if there were firms assembling motor cycles from cheap imported parts in 1912, they did not survive for longer than the briefest period. This proposition then is premature and anticipates a situation which did not occur until much later in the industry's history.

Summary and Conclusions

From 1908 to the outbreak of war in 1914 the output of the British motor cycle industry increased more than ten-fold. In a very few years the industry had grown from what was little more than an offshoot of the cycle industry and of small commercial significance into a major industry with an output worth millions of pounds a year. At the same time, its export trade, once of only moderate significance, had come to dominate the world market, its value increasing to well over a million pounds a year.

The first and most important step towards this explosive growth of the British industry was the development by Triumph of a motor cycle which, while relatively simple in principle, offered a degree of performance and reliability which was capable of not only winning major races, but at the same time represented a best buy to the consumer concerned only with day-to-day riding. Racing success has always been the most effective form of motor cycle advertising, but it was particularly important when there was little difference between the standard road going machine and the racing model. The Triumph was literally everybody's motor cycle.

The Triumph 3½hp motor cycle was already a major commercial success in 1907 when it took second place in the first ever TT race. When it took first place in the 1908 race it must have confirmed for many firms, if confirmation were still necessary, that this was the type of machine they ought to be producing. The message was clear: for commercial success, imitate the Triumph.

The opportunity and willingness to imitate the Triumph—the first machine to win the confidence of a large number of consumers and retain it over a long period of time—was the next major step in the industry's growth. From 1909 firms which had dropped out of motor cycle manufacture four or five years previously, along with others which had never produced motor cycles before, began to enter or re-enter the industry with machines which were very much like the Triumph. Some of these new products

were almost exact copies, some were rather more innovative; but whether they were deliberately imitative or simply following the current fashion, there is no doubt that it was Triumph far more than any firm which had established the fashion and indicated the way motor cycle development should proceed.

By 1910, to judge by the figures of motor cycle use, the industry was growing fast. It maintained a high rate of growth right up to the outbreak of war in 1914, but not all of this growth can be attributed to the production of Triumph type machines. There was a constant flow of new and highly innovative models, some of them entirely untypical of the current standard. The new models met with mixed success. Some of them apparently failed commercially and were soon withdrawn; others remained in production suggesting they achieved a degree of success, but figures are lacking to indicate just how much; two were to be proved outstanding, the Douglas and the Scott.

The relative commercial success of the Douglas and the Scott is illustrative of the importance of the standard type of machine. From their first appearance both machines were almost constantly in the public eye because of their competition successes, and both proved to be exceptional machines from the ordinary rider's point of view also. Both were unconventional in design but the Douglas much less so than the Scott. The Douglas had a new type of engine installed in a standard type of frame and was conventional in most other respects. The Scott was original in frame as well as engine design and in other respects also. It was substantially different in appearance from the standard machine.

In 1912 both machines were successful in the TT, the Scott winning the Senior race and the Douglas the Junior. Yet output for the Douglas was already in the thousands while for the Scott it was still in the hundreds, and Douglas was soon to become the largest manufacturer apart from Triumph while Scott remained somewhat smaller. Although there may have been other factors to account for

this difference, for example, the Douglas was a lightweight and cheaper than the Scott, the greater commercial success of the Douglas was, despite its innovativeness, almost certainly to a large extent the result of its more conventional design.

The growing success of these relatively unconventional machines and of the longer established V-twin, prevented the industry from becoming overdependent on the one standard and stimulated the development of new types of machine. This was the third major step in the industry's growth.

The 3½hp Triumph was a kind of maid-of-all-work: a machine suitable for day-to-day riding, touring, capable of hauling a sidecar, and, with only minor modifications, of winning major races. It was a good buy for many riders, but less good for many others. For town or local riding a lighter, cheaper machine, might be better. For sidecar work, a more powerful, multi-cylinder machine might be preferred. Both of these types were developed further in the years immediately preceding the war, and particularly the lightweight. The Douglas, a lightweight, may or may not have influenced the trend towards lighter machines, but it certainly encouraged the development of larger ones powered by the type of engine it had pioneered, the flat twin. The Scott certainly influenced the wider adoption of the two-stroke engine, and as it turned out, the lightweight, two-stroke machine was the cheapest one to make.

Many new lightweights were put on the market between 1913 and 1916, some of them costing as little as £23, about half the price of a basic Triumph. At such a low price they brought motorcycling within the reach of a much wider section of the population than previously, and helped to bring about a substantial further expansion of the market.

Given that this expansion was a result of not just the wider imitation of the standard Triumph type, but also the development of new types of machine, would it be correct to say that the trend to standardization was weakening? The answer to this question depends on how far the new types of

machine represented the development of new product classes (product class defined by intended use) and how far they were used in the same way and for the same purposes as the older types of machine.

There is in fact little doubt that the new, cheap lightweight was the prototype of the modern commuter machine, and the latter can with considerable justification be treated as representing a different product class as compared with, say, the touring machine which is much heavier, more powerful and more expensive. Much the same thing might be said of the machines specially designed for sidecar use. Yet if the rider so wishes all motor cycles can be used for touring or other purposes for which they were not specifically designed. There are limitations here, however, since a heavy machine designed for sidecar use can easily be used for touring, but a lightweight cannot be used to haul a sidecar. Thus the development of new types of machine, particularly if the latter are intended for more specialised uses, does not necessarily run counter to the trend to standardization. Only if the new types compete directly with existing types will this be so.

From a technical point of view, the majority of even the more innovative machines were in harmony with the older ones in many respects. Both heavyweight and lightweight tended to follow the established pattern in terms of frame design and general layout. Engines might vary in accordance with the degree and type of power needed, but ignition systems, transmission systems, clutches, gear boxes, springing, seats, lighting, brakes, controls, and other features might be very much the same. Thus that the trend to standardization might continue and even be strengthened does not mean that every motor cycle would become like every other. The trend indicates a tendency, not a conclusion. There could be a high degree of standardization across all types of machine for some features, combined, at the same time, with a high degree of variation in features which relate to specialised uses.

Thus the industry grew rapidly because of the

development of a reliable standard machine, the Triumph, the imitation and improvement of that machine by competitors, and the development of new types of machine offering more specialised performance. But all of these developments were commercially successful only because they served the interests of the consumer and satisfied him to a reasonable degree for the first time in the history of motorcycling.

The reputation of the Triumph was built on its reliability at a time when the typical motor cycle was expected to be unreliable; a time when the rider was advised never to travel without a large collection of tools and spares. Until then the market was bound to remain small with most potential motorcyclists remaining on the sidelines along with some of the potential motor cycle manufacturers.

Once Triumph had provided the formula for a reliable machine, it was not difficult for other manufacturers to produce one with comparable if not equivalent consumer appeal. Some were willing to wait a while at this stage while others set out to woo the consumer with more and more improvements like, for example, twin and four-cylinder engines, variable speed gears, kick-starters, spring frames, electric lights, and so on. The new systems did not always work and much still remained to be done, but the enormous increase in the numbers of machines in use indicates that the motor cycle was now long past the time when its appeal was limited to the innovative consumer with a taste for "the hazardous, the rash, the daring, and the risky". It was now a machine for everyman or woman, provided he or she could afford one.

CHAPTER 13

CONCLUSIONS

The research effectively began with the problem set out in Chapter 1 as follows: to explain how the relatively diverse and innovative product make-up of the industry in its earliest days first began to evolve into one that was rather more standardized and conventional.

In deciding how this problem might be investigated, several secondary or methodological aims were formulated under the headings: (1) historical, (2) conceptual, (3) analytical, (4) integrative, and (5) further research. Thus the research would involve a study in history, concept development, conceptual analysis, the merging of concept and data with a view to achieving a better understanding of particular historical processes, and ultimately the consideration of how far the research itself can act as a stimulant to further research along similar lines.

All of these issues will be considered in this chapter though sometimes under different headings. First it is necessary to consider the research as history.

1. The Industry, 1896-1916

After a late start because of the legal restraints of the Locomotive Acts, the British motor cycle industry had within twenty years grown to become the world's leading producer of motor cycles and suppliers of about 70% of the world trade. Yet the beginnings of the industry had provided not the smallest clue to this outcome.

As a child of a thriving cycle industry, the motor cycle industry had no lack of parent firms, but the early entry to the industry of a substantial number of cycle manufacturers achieved little towards establishing the new industry. What was lacking was not the productive resources, but the technical know-how to turn a standard

bicycle or tricycle into a motor cycle. The most important single requirement for this operation was a knowledge of internal combustion engines, but such knowledge was particularly lacking among British engineers. Consequently it was not the British who led and promoted early developments in motor cycle manufacture but continental firms founded by experimenters whose main strength was a knowledge of engines and a willingness to try out almost any idea that occurred to them.

With little alternative, the British industry learnt its trade by imitation of foreign designed machines which, poor as they were, did work just well enough to suggest that motor cycle production might just possibly become a viable proposition in the foreseeable future. There was little prospect of future progress, however, for an industry based on imitation of machines which were hardly worth imitating since they were not good enough to attract sufficient business to sustain the industry.

By the end of the experimental period the first successful British designed machines were beginning to emerge, but these were for the most part only short-term successes as the most important developments continued to come from the continent.

The first of these developments was a Belgian machine, the Minerva, which in its simplicity of construction and basic good design for the period, triggered off the first major expansionary period of the British industry as many firms began motor cycle production for the first time with imitative models.

Soon after the Minerva came the new pattern Werner which was more significant still since it was the first design with the potential to be developed into a long-term standard motor cycle to gain widespread recognition. So far, even the best machines had lacked this potential in that they were based on designs which had only a rather limited capability for improvement.

The main advantage of the new Werner was in its engine placing which gave it a degree of stability which most

earlier machines had lacked. Imitators were not slow to take note and the new machine was soon widely recognised as the design of the future. Within two years of its appearance the Minerva had been almost entirely supplanted by the Werner, and from then on motor cycle development became increasingly concentrated on improving the Werner type machine rather than attempting to develop new designs.

In the years 1901-3, covering the appearance of the Minerva and the new Werner, more than a hundred firms entered the industry (Table 13.1), production expanded, and it began to seem that Britain at last had a viable motor cycle industry. But this was not so. In 1904 with production perhaps around ten thousand machines a year, it became

Year	Entered	Left	Remainder
Before 1901	24		24
1901	26	5	45
1902	50	4	91
1903	42	12	121
1904	18	11	128
1905	16	20	124
1906	6	31	99
1907	8	11	96
1908	10	16	90
1909	12	3	99
1910	10	4	105
1911	20	8	117
1912	18	6	129
1913	26	12	143
1914	11	30	124
1915	4	20	108
1916	1	7	102
Total	302	200	

Table 13.1. Firms Entering and Leaving the Industry,
1896-1916¹

apparent that the market was still rather limited and could not absorb such a number. By 1905 a slump had set in and more firms were leaving the industry than entering it.

The failure was one of technology rather than marketing. The motor cycle was still not good enough technically, still not sufficiently reliable, to attract in any number newcomers from among the less enthusiastic section of the population. The enthusiast, the adventurer, might be willing to accept the hardships and risks of pioneering motorcycling in exchange for the thrills of speed, the achievement of competitive events and, on a fine day, the rare but obvious pleasures. But the people who would one day play the major role in forming the expanding market on which the future of the industry depended, were those who would buy motor cycles largely for utilitarian purposes, for riding to work or holiday touring, and would see little appeal in motorcycling for its own sake.

The result was a sharp contraction in the industry with many firms dropping out and production in 1907 down to half of what it had been two or three years earlier. To some commentators the industry was now facing extinction: the young industry, never really viable in the first place, seemed to be little more than a passing fad. This was not true and the industry was never really in danger of extinction.

When the industry began to contract it was a matter of the survival of the fittest for motor cycle manufacturers, and the fit did survive. While lesser firms were dropping out, Triumph and a few others were working to improve their products, and some of them, but Triumph in particular, were expanding their production at this time. It was Triumph more than any other firm which developed the motor cycle into a product with long term staying power, the industry's first definitive standard model and one with sufficient consumer appeal to generate substantial and continuing growth in production.

This development of such a standard machine marked the end of the development phase of the industry's evolution

and the beginning of the standardization phase, the period when the product would tend to become standardized across the industry as a whole. The next major step towards this outcome was the widespread imitation of the standard design.

Many firms imitated the new standard, the Triumph motor cycle, and from 1910 onwards the expansion of production was extremely rapid. From 1907 to 1913 annual output must have increased at least tenfold earning for Britain world leadership of the industry. But this achievement was not entirely based on the Triumph machine and its imitations.

The first British motor cycle design with potential long-term viability appeared in 1900, and others followed from about 1903 onwards. Most of these machines and particularly those which appeared before 1907 were soon withdrawn as their producers discovered that it was almost impossible to sell an innovative design at a time when the market was extremely limited.

As the market expanded, however, led by the demand for Triumph type machines, it appears that the motor cycle in general was gaining increasing public acceptance. Thus from about 1909 onwards, new designs which three or four years earlier would probably have been rejected were now surviving and beginning to achieve a degree of commercial success.

The success of these new designs, the products of such firms as Scott and Douglas, owed much to their high quality and performance, but some of the new designs which had failed commercially in earlier times were probably no less good when compared with the typical machines of their day. The Phoenix Cob of 1905, a high quality innovative design, had failed to sell in sufficient quantities to keep the firm in the industry. In contrast, the Douglas, an innovative machine coming onto the market just a few years later, became, after a slow start, one of the best sellers of the motor cycle industry.

The new designs encouraged the development of new

types of motor cycle, particularly the low-priced light-weight machine usually powered by a two-stroke engine, which contributed further to the expansion of the market and the consolidation of the industry as a whole. Thus the standard machine in the form of the Triumph type, began to lose ground from about 1912 onwards to other types although it remained the most popular design.

The war resulted in a slow contraction of the industry as many firms' resources were turned over to munitions work, but it also brought about the widespread use of motor cycles by the British armed forces for the first time. For those firms which served this need, and particularly for Triumph, Douglas, Clyno and P & M, the war caused not a contraction in production but an expansion. Thus it was far from being a disaster for the industry even though motor cycle production for civilian use was banned from November 1916.

In concentrating on the development of the industry in terms of the development of its product, the research as history has been able to take advantage of a considerable quantity of material derived from both trade and popular journals and not previously used for this purpose. These sources have been used before to provide material for popular studies of the development of the motor cycle, but never to study the development of the industry itself.

The research, however, has neglected inevitably and by design a number of other topics with relevance to the history of the motor cycle industry. There is a natural limit to how much can be achieved within any particular research project, and in research as potentially wide-ranging as this, it has been necessary to restrict rather than widen the scope and range of the research as it has progressed. Thus although subjects such as capital formation, entrepreneurship, and the type of firm have been given some mention in particular cases, they have never been central to the research as planned and have been to a large extent avoided. Clearly there is work to be done in these areas although data might be rather limited.

Key issues for more immediate further discussion which arise from the research as history are the role of the product in the development of the industry; and the different approaches required for successful product development in different phases of the industry's development. These are discussed in Section 4, "Integration".

2. The Trend to Standardization

The trend to standardization is a natural tendency observable throughout the world we know. For the most part it is not consciously sought, but is driven by the need to survive in a competitive and often hostile environment, and one that serves best those most capable of the necessary adaptation, those who may be termed the fittest, with fitness being defined solely in environmental terms without reference to abstract or objective concepts of fitness.

Thus where products are concerned, the fittest are those which sell to the most profitable degree. Such products need not be the best in terms of performance, they need not be of particularly good quality, they need not be cheap, they need not be expensive. But whatever their specification they must appeal to the consumer, otherwise they will not sell at a sufficiently high profit to survive in the marketplace and keep the producer in business.

Those products most capable of achieving high profits will be widely imitated, and it is as a result of imitation that the best product in these terms will set the standard. Thus the trend to standardization in product development operates largely through imitation.

As a preliminary to investigating the trend to standardization in the motor cycle industry, two propositions were formulated and presented in Chapter 4 which have some bearing on the matter. These are discussed below.

1. As a new industry develops, product design across the industry as a whole tends to change from highly diverse—a multiplicity of different models—towards convergence around one or a few standard models.

As we have seen in Chapters 7 and 8 particularly,

there were many more different product designs in the earlier years of the motor cycle industry than later on. The most obvious variation in early designs was engine placing, and perhaps as many as ten or twelve different locations for the engine were tried before the vast majority of models settled down to the one standard placing, low down between the two wheels, which has survived to the present day. The establishment of the latter position was the most important step in the development of the standard that eventually came to dominate motor cycle design.

By 1909 the overall product make-up of the industry was beginning to converge around the one standard model, the Triumph. But motor cycle development did not stop there. From about 1911 or 1912 other designs began to achieve increasing prominence and the Triumph type began to lose ground somewhat although it still remained the most popular type of machine overall.

But if the Triumph type were now being challenged, the challenge was nothing in the nature of a radical redesign. For the most part the new designs were not radically different from the Triumph except in engine type. In many respects including frame and basic layout, and many lesser details, they still resembled the Triumph and would continue to do so.

What some of the new machines did offer, however, was variation in performance which indicated the possible development of two new product classes among motor cycles, the heavyweight machine particularly useful for sidecar work, and the cheap lightweight machine, the commuter motor cycle of the future. The development of motor cycles for new uses, which may differ somewhat from other types of machine, does not in any way run counter to the trend to standardization itself, although it does indicate that this proposition should be modified to take account of different product classes. A commuter motor cycle is obviously not going to be the same kind of thing as a heavy duty sidecar machine.

2. As a new industry develops, innovation tends to change from the more radical in character to the more conventional, such as improvements to standard models.

Truly radical innovation in motor cycle technology ceased to be a profitable activity with the development of the new Werner back in 1901 (except for the scooter which came very much later and outside our period). From then on, in order to make money with any certainty, producers had to concentrate on improving the Werner type.

Early Triumph models were all imitative, first of the Minerva, later of the Werner, and Triumph's success in developing the machine which became the industry standard was achieved by improving the Werner type. Even Triumph's "ball-bearing" engine, the first of its type, was essentially an improvement on existing models rather than the result of a radical redesign.

This is not to say that there was no more radical innovation; there were many radically new designs but they rarely made much money and few of them survived more than a few years. The only exception to this rule in our period was the Scott which has been discussed at length in Chapter 9. The Scott, however, despite being an outstanding machine, despite achieving considerable commercial success, never came anywhere near to the output of less radically new designs like the Douglas.

Such new machines as those with flat-twin engines like the Douglas, or with two-stroke engines following to some extent the Scott, usually resembled the Triumph in basic layout rather than the Scott in its radically new design. Thus the tendency to move away from the radical innovation and towards the more conventional applied even to these machines, and was not set aside by the development of new types of engines.

Meanwhile, there was a continuing and growing effort to improve on the standard Triumph type. At one time and particularly in 1910, it was possible for a firm to enter the industry with an almost exact copy of the Triumph and

make good profits almost immediately. But whether through increasing competition or because the firms in question were aiming to increase their share of the market, there was an increasing tendency to offer the standard machine with significant improvements like, for example, variable gears. These efforts helped it to retain most of its popularity despite the superior performance in some respects of such as the Douglas, Scott and others.

There is no doubt then that the overall product make-up of the industry did tend to evolve from relative diversity towards a few standard models. The Triumph was the first industry standard, but with the growing popularity of the V-twin engine, the development of the flat twin engine of the Douglas, and the development of the two-stroke engine, there were by 1915 arguably at least four standard types of machine. Yet despite the fact that a middle-weight motor cycle like the Triumph might be powered by any one of these three alternative engines, in practice this was not usually the case. The majority of machines with two-stroke engines were lightweights, while the V-twin machines were usually heavyweights. Thus looking at any particular product class there was less diversity than might be expected given the potential range of different designs.

It is apparent therefore that the trend to standardization had weakened slightly since 1910 when every firm seemed to be mainly interested in imitating the Triumph. The trend, however, was never altogether a linear phenomenon; it tended to wax and wane in a cyclical fashion, weakening temporarily after a particularly significant innovation, and strengthening as that innovation was more widely adopted.

In the early period ending about 1902 there was a particularly high number of different product designs. Production tended to become increasingly concentrated on the new Werner type which became the acknowledged standard about 1909 in the form of the Triumph. But from then on

there was a new period of significant innovation so that the trend to standardization which had been particularly strong from 1902 onwards began to weaken. Later on and beyond our period, the innovative flat twin and the much improved V-twin of the 1909-1915 period would almost disappear from the market and the two-stroke would become almost entirely restricted to very light machines, as the trend strengthened again.

Similar effects can be observed with regard to detail improvements. The introduction of a new kind of brake or gear box would initially create diversity of design until the innovation had become the new standard or been rejected. In the short run therefore the trend can be reversed, but in the long run it will almost inevitably prevail.

3. Analysis of the Trend

In analysing the trend to standardization in Chapter 2, three main elements were revealed: functional efficiency standardization (FES), production efficiency standardization (PES), and marketing efficiency standardization (MES). Rather than use these concepts specifically as the basis for the discussion of more substantive issues, they were used instead along with other ideas in the formulation of the propositions presented in Chapter 4. Nevertheless, they are worth reconsidering at the present stage.

Where product development is concerned, MES is clearly the most important element. It is the nature of the market which determines the best kind of product to manufacture, and therefore the degree to which FES and PES are relevant.

The role of PES is rather problematic. When motor cycle production began there was a clear advantage for firms which based their machines on standard cycle frames modified to the smallest extent necessary to allow the machine to carry the engine. This was a good example of PES and brought the expected benefits in the form of lower production costs as compared with those machines which were based on nonstandard frames as for example the Holden.

It should be emphasized, however, that such machines

as the de Dion-Bouton motor tricycle and the Werner motor bicycle, both based on standard frames, were not designed that way for the benefits of production efficiency standardization. They were designed initially as experimental models with no thought of production, and the standard frames used were used because they were the types most readily available.

Following the lead of these firms, however, the motor cycle became very firmly based on the standard cycle frame. de Dions and Werners were the first machines that worked, the first recognised standards, and so as they were imitated the majority of motor cycles were based on the standard cycle frame. The continuation of such designs at the expense of more innovative designs based on new types of frames, was in no way a result of PES. It was simply because once the standard cycle frame had become established in motor cycle design, the consumers would have nothing or almost nothing else. Thus the rejection of machines such as the Phoenix Cob and the James design of 1908, was nothing to do with PES but was a result of consumer conservatism.

Throughout this period production methods were improving; there was increasing awareness of the importance of interchangeable parts, and the continuing development of better machinery which would simplify production and improve the quality of components. Nevertheless, as pointed out in Chapter 8 (p. 177), parts were often not interchangeable and consumers did complain to the effect that machines were apparently constructed much as might have been the case a hundred years previously when parts had to be filed in order to fit. Yet the letter from Rex (pp. 161-2) indicated that some manufacturers were aware of the gains to be made from improved methods of production and were taking steps in this direction. Rex though was one of the larger firms. For the majority, whose annual outputs were to be measured in hundreds rather than thousands, there may have been little justification in commercial terms to spend money on improving their methods of

production.

Triumph, the largest firm in the industry from about 1908, was the firm best placed to make gains from the introduction of the kind of advanced technology which would both improve quality and reduce costs at the same time. There is no indication, however, that they did make any move in this direction since their products although always noted for quality, were never cheap.

The one class of product where there was some sign of an interaction between FES and PES, modifying design to reduce cost and simplify production, was the two-stroke lightweight type of machine which appeared just before the war. Here we find a very simple machine being sold for not much more than £20 because of two factors: the new and relatively simple two-stroke engine and the willingness to ignore some of the recent advances in motor cycle technology such as variable gears, and offer the most basic type of motor cycle. Functional efficiency was clearly being sacrificed to production efficiency so as to offer machines at the lowest possible price.

At no time did this mean, however, that products were being simplified and standardized so as to facilitate the adoption of mass-production methods. Most of the firms offering the cheaper two-strokes were small with outputs of no more than a few hundred machines a year and clearly had no need for mass production methods. Also, although these firms offered very simple, cheap, basic machines, they did not reject the more advanced technologies absolutely but offered them as extras. There was none of the Henry Ford "so long as its black" type of approach, and given such small outputs, this would almost certainly have been premature.

Thus production efficiency standardization was limited during this period to the early adoption of the standard cycle frame as the basis of the motor cycle, and increased efforts to make parts that were more truly interchangeable. These efforts would eventually simplify the adoption of mass-production methods, but that was still a very long

way off, and there is little evidence at this time that motor cycles were ever designed specifically with a view to improving production efficiency. There is a profound difference between improving production methods so as to manufacture better quality interchangeable parts and actually designing products with a view to making them easier to manufacture.

In any case, it seems unlikely that there was any significant progress along these lines in the British motor cycle industry at that time, since as recently as 1975 the industry was criticized for failing to focus on "designing products which were intrinsically low cost to produce".² In fact the industry has always been inclined to design products mainly with reference to functional efficiency rather than production efficiency.

Issues of design for improved performance (FES), therefore, were rather more significant. The main conflict or interaction among the different elements of the trend was between FES and MES. There was often a considerable lag between design potential, the most efficient design in functional terms, and the standard or what the consumer would accept. It was this lag which accounted for the failure of many very good innovative products which were placed on the market anything from five to perhaps fifty years before their time. Exactly how much innovation or how much variation from the standard the consumer would accept is the subject of the last group of propositions which are discussed below.

15. Products which are innovative enough to diverge considerably from any existing standard, whether premature or otherwise, and whether in terms of price, appearance, basic technology or performance, may be difficult to sell initially even when they offer the consumer distinct advantages as compared with other products.

There is evidence for this proposition from the earliest days of the industry. The Ariel motor tricycle of 1898 was technically innovative and somewhat superior to

the existing if rather premature standard, the de Dion-Bouton tricycle. It was greeted initially with scepticism by the motorcycling press, and although opinion did eventually change very much in its favour and it sold in reasonable quantities, it never made a profit.

The Binks four-cylinder motor cycle of 1903 suffered a similar fate. As a design it was much more radically innovative than the Ariel, but it may have been difficult to sell more because of the high price than the new technology, since a similar but much cheaper machine, made in Belgium, was a commercial success and remained on the market for many years.

Machines of the so called "bicar" type of 1905-6, usually untypical in appearance and of new technology were also rejected despite good performance.

Probably the most important example of a machine which was initially slow to sell, was the Douglas. Of fairly new technology and moderately unusual appearance because of its innovative engine, it was laughed at when first displayed at one of the motor cycle shows in 1907 and not a single machine was ordered. Within six years it was one of the industry's best sellers. Thus there could be considerable consumer resistance even to the best of new products.

16. When any product that is recognised or recognisable as a standard has appeared on the market, the only ways to innovate successfully are either to imitate and improve on the standard or to develop something obviously superior in terms of price or performance.

This proposition follows directly from the definition of the standard as the most popular product on the market. It does, however, provide another way of looking at the standard and its consequences for innovation. Its main implication is that innovative products which offer little or no visible advantage in terms of performance or price will fail commercially. Thus there would be little to be gained in developing a new type of engine if it produced

little of advantage as compared with established types, but even given that the new engine were superior, that superiority would have to be obvious to the consumer before he could be expected to show much interest.

This point does explain the early rejection of the Douglas and its later acceptance. When it first appeared it was obviously new and different from the existing standard, but there was as yet no evidence that it was in any way to be preferred. Its gradual acceptance was the result of two factors: consistent success in competitions and the growing awareness, probably spread by word of mouth from Douglas owners, that here was a particularly pleasant machine to ride, the smoothest-running machine yet produced.

The road to commercial success through innovation, however, was much easier for those who improved on the standard in relatively minor ways, like, for example, the addition of a two-speed gear to the Minerva type as on the Phoenix of 1902, the improvement by Triumph of the Werner type later one, and the improvement of the Triumph type after 1910 by the addition of variable gears as in the very successful New Hudson machines.

Against these examples, there were many failures (or only limited successes) among the more innovative machines which differed from the standard, and were in many ways superior to it, but the advantages of which were not sufficiently visible to impress the consumer. In present day terms the failure was a result of poor marketing, and it is significant that the most successful innovative machines were those that were successful in competitions and were widely advertised with the details of competition success prominently displayed.

17. Products are more likely to be imitated when they are based on simple or familiar technology.

18. Products based on new technology are more likely to remain exclusive.

In that they say much the same thing although in

different ways, these two propositions can be discussed together.

There is some connection here with the production efficiency aspect, notwithstanding what has already been said about PES. Firms at this time did not aim to design their products with a view to adopting cost saving production technology; rather they tended to avoid getting involved in advanced technology very likely because they saw a better commercial opportunity in the simpler design based on known technology.

As was indicated in Chapter 3, it is often advantageous for the firms developing new products to rely on familiar rather than new technology, and in the period covered by the research it is apparent that the majority of firms preferred to avoid the newer technology.

Early attempts to develop machines from first principles, that is with new types of frame and new types of engine specially developed for the purpose, even when achieving some kind of success, were almost never imitated. Obvious examples are the H & W and the Holden almost no feature of which was incorporated into another machine. It was much easier to use standard cycle frames and modify them as required and, where engines were concerned, to do as de Dion-Bouton did and imitate the early Daimler engine. Even the electric ignition of the de Dion-Bouton tricycle was too complicated for the majority of British imitators and they used instead the hot tube with its simple flame burner.

The great strength of the first successful motor cycle designs was that they were always based initially on standard tricycle or bicycle frames and were therefore easy to imitate. Against this it is almost impossible to find an imitation of a machine with a nonstandard frame. The most popular of the early machines, the de Dion-Bouton tricycle, and the Werner and Minerva motor bicycles, were all based on standard cycle frames. The Triumph of a few years later was based on a frame which had evolved from the same standard cycle frame. The Scott was the only machine with a

nonstandard frame to achieve any great popularity, but there were no imitations.

Among other machines which had original features which remained exclusive for some time, were the Phoenix with a two-speed gear, the FN with a four cylinder engine and shaft drive, and the ASL with air springs.

Some of the simpler innovations, however, were imitated rather quickly. The best example of this was the oil pump first introduced on the Phoenix. But against this, the kick-starter, introduced on the Scott, and very simple in principle, did not become universal for several years.

Probably the major factor in imitation was relative advantage as compared with older technology, and the degree to which the advantage of the new was visible and simple to apply. But producers also had to take account of the caution of the consumer and rarely adopted an attitude of change for its own sake as seems to occur today rather too often. Although there were many complaints about products, there were always consumers who were quite happy with a product whatever its drawbacks, and justified a conservative product policy for the majority of producers, which tended to restrict imitation to the more standard designs based on familiar technology and the simpler innovations.

19. New products which depart from the standard will be most successful commercially when they differ only in terms of price or performance, will do less well when they differ in basic technology, and will do least well when they differ in appearance. In other words, it will be easier to trade off other factors in favour of price or performance than in favour of new technology or new appearance.

A departure from the standard through a reduction in price could hardly be expected to reduce its saleability provided quality was maintained. Machines more expensive than the standard tended to do less well though this was not always the case. The Sunbeam, of conventional design

but built to the highest standards of craftsmanship, was relatively expensive but a major commercial success, nevertheless. Consumers were willing to pay more for the extra quality.

An improvement in performance as compared with the standard would rarely have affected sales for obvious reasons. There is no data on standard type machines which lacked the expected level of performance.

Where appearance was concerned the effect was quite striking. The vast majority of machines of untypical appearance either failed commercially and were withdrawn fairly quickly, or although they remained in production for some time did not achieve a sufficiently high degree of commercial success to come to general notice. As has been noted already, the Scott was the only machine of substantially untypical appearance to achieve a major commercial success. Among those which failed or were soon withdrawn and ignoring early experimental machines, were the Binks, the Phoenix Cob, the Zenith Bicar, the 1908 James, and the 1910 Roc (fig. 13.1). All of these were of advanced

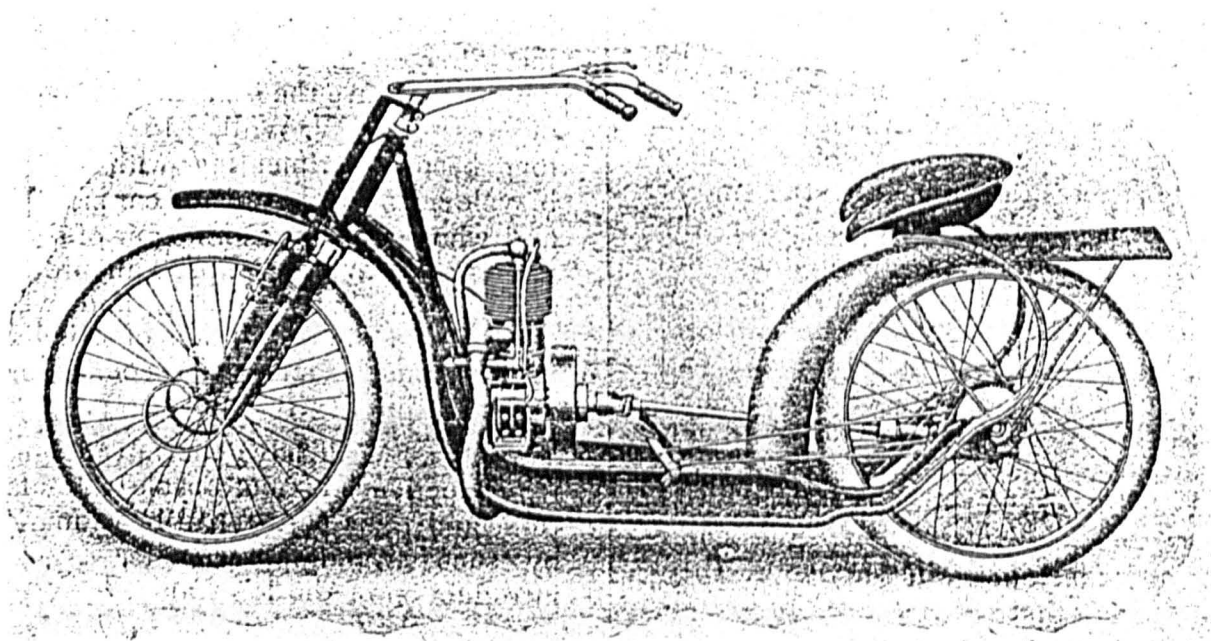


Fig. 13.1. The Roc
("Motor Cycling", 22 November 1910)

technology and not particularly cheap, but apart from the Binks were not expensive either.

It is harder to find cases where new technology was rejected initially without at the same time being combined with the effect of radically new appearance. The most obvious case is the early rejection of electric ignition. Apart from this example, the slow adoption of much new technology suggests that whatever its potential for commercial exploitation, producers in general remained cautious. There is little evidence, however, that when new technology was applied to existing standard models they were difficult to sell, but the lack of production figures for particular periods leaves this an open question.

The aim of this proposition is to suggest that there exists a hierarchy of innovations in terms of deviation from the standard, which correlates inversely with the chance of commercial success; that is, the higher the degree of deviation from the standard through innovation, the lower the chance of commercial success. Although evidence is limited, what evidence there is leaves no doubt that the most visibly radical design will be the most difficult to sell. Innovation that takes account of the existing standard and does not deviate too much from it is the most likely kind to succeed.

The great significance of appearance in defining the standard product is not hard to explain. In order to learn to trust a particular kind of product, consumers have to have a way of recognising it, and appearance is the easiest and most obvious way. Recognising the standard product by its price might seem at least as simple but this is not necessarily the case. Every one recognises that quality is likely to be related to price but few are able to judge quality. A product might be of higher quality or it might just be more expensive, and it can be very difficult to know which. Technology is even more difficult for the average consumer to understand. Even enthusiasts may for a time be baffled by new technology. But appearance is easily understood. Many people believe that if something

looks right it is right, and this would explain why the standard product will have a standard appearance and why products of untypical appearance are usually rejected.

Summary

The most important element of the trend to standardization in product development is the market. The nature of the market determines which product and which kind of product will set the standard. The standard itself will be largely a result of consumer preference.

In the early motor cycle industry consumers were extremely reluctant to adopt a product which did not conform to ideas about the standard. The standard evolved through a long learning process on the part of producers as well as consumers, but since most consumers were already familiar with bicycles and tricycles, any motor cycle that was based on cycle technology had an obvious advantage in gaining consumer acceptance. This would help to explain why more advanced technology, particularly when it altered the appearance of the machine, was very likely to be rejected, and why almost all the popular machines of the entire period were based on cycle frames or frames which had evolved from cycle frames with a minimum of modification. Basic format or appearance was the most important factor in the acceptance or rejection of an innovative machine.

Technology aimed at improving functional efficiency was the major factor in the development of innovative machines, and probably the most important cause in the development of machines of untypical appearance. In view of the unpopularity of machines of untypical appearance, therefore, appearance was a major limiting factor in the development of better motor cycles. Commercial success was in most cases dependent on maintaining standard appearance, and therefore commercially successful innovation required that the innovation be incorporated within the standard format. Technical innovation therefore in the interests of functional efficiency was always inhibited to some extent by the nature of the current market standard. It may

reasonably be argued in fact that technology was self-limiting.

There is little or no indication that at this time production efficiency was a conscious factor in design, though producers did tend to concentrate on designs which were simpler to produce. But these same designs were generally the most popular and so this fact does not constitute evidence of concern with production efficiency.

4. Integration

The purpose of this section is to discuss the relationship between the early history of the British motor cycle industry as studied in this research and the concepts which have been developed to illuminate it. Some elements of integration have already entered into the discussions of the last two sections, and also in the discussions of the propositions through Chapters 7, 8 and 12. There are two issues, however, that are worth further discussion: the role of the product as influenced by the trend to standardization in the development of the industry; and the different approaches required for successful product development in different phases of the industry's development.

The Standard Product

The most crucial event in the development of the industry in these early years was the development of a worthy standard product, a product which was, although far from perfect, satisfactory from a consumer point of view. Until the development of the Triumph model of 1907, motor cycles in general had a reputation for unreliability. Furthermore, they tended to wear out remarkably quickly. They could also be uncomfortable to ride, dangerous, and in certain circumstances, lacking in a desirable level of performance, such as, for example, the ability to go up hills.

All of these factors were slowly being improved, but until the necessary level of reliability was achieved, the motor cycle could never appeal to the wider market on which

the future of the industry depended. Even so, reliability was not enough. A standard machine did not just have to be reliable but also of such a design as would appeal to the majority of consumers. It may be that one of the untypical, rejected machines of the day would have served just as well as the Triumph in terms of performance, but it could not readily have become the standard because it would not have been acceptable to the majority of consumers.

The significance of the trend therefore was in marking out a type of machine which once sufficiently developed could serve the whole industry as a standard. Almost as soon as the Triumph began to perform at the requisite level, it was recognised for what it was and the widespread imitation followed which resulted in the extremely rapid growth which secured for the first time the future of the industry.

Product Development and the Three Phases

New products generally had a better chance of success if they were in phase with the industry's development. The most successful products during the experimental phase were experimental products. Inventor firms like de Dion-Bouton, Werner, Perks & Birch (and later Singer who bought their design), and Minerva, were almost the only ones to do well financially with products developed up to 1900.

Against this, the many imitators of these products (except for some of those imitating the Minerva later on), did rather badly. There were two main reasons for the failure of these firms. First, they lacked the basic know-how to produce successfully imitations of even fairly simple machines. Second, the market was too small to dispose of sufficient quantities of machines to keep thirty or forty imitators in business. In a small market the originator of the product could supply much of the demand, and many consumers would prefer the original product which was of known reputation and performance to the untried product of an imitator. The result for many imitators was an output of no more than one or two machines a week which

was hardly worth the effort of becoming familiar with the new technology involved.

The developers of this phase, those trying to improve existing designs, did little better mainly because of the small size of the market combined with the high cost of development which was compounded at times by ignorance of the necessary technology. In such a small market, even a rather good new product like the Ariel tricycle could not sell in sufficient quantities to recoup development costs.

Although invention continued on a smaller scale during the development phase, and imitation on a much larger scale, the more successful firms were those which took one of the promising new designs and worked to improve it. Among these were van Hooydonk with the Phoenix, probably the only firm to carry out significant improvements with the Minerva type, and Rex and Triumph with the new Werner type.

Most of the imitator firms of this period did rather badly as indicated by the large number which entered and left the industry within a very few years. The inventor firms, those with radically new designs, did little better.

During the standardization phase, there is no doubt at all that the easiest way to make money was to imitate the industry standard in the form of the Triumph, and some firms, like BSA, for example, did achieve large output by imitation alone. As competition increased, however, there was more opportunity for producers of improved standard type machines, like New Hudson and Rudge. The rising level of performance may also have encouraged the increasing demand for more innovative products provided they did not stray too far from the standard format. Among these were the Douglas, Matchless, Williamson, Clyno, and several others and their success does suggest a slight weakening in the trend to standardization.

The Scott was the only entirely untypical machine of the standardization phase to achieve significant commercial success, but it was the exception which proves the rule, and from now on commercial success would be likely to

depend on producing models which, however innovative, would conform to a large extent to the standard format of the motor cycle.

5. Further Research

The path of this research indicates several areas in which further research would be worth considering. These include (1) studies of a similar nature to this one but applied to other industries; (2) studies which go beyond the present frames of reference that is into the more mature stages of industry development, but use some of the same concepts that have been developed here; and (3) further work on the concepts themselves, the trend to standardization, its three main components, and the three phases of industry development, but perhaps with the emphasis on comparative studies across several industries rather than on single case studies.,

1. Studies of a similar nature to this one but applied to other industries.

Several questions of interest arise here. One of the most obvious is how far is the trend to standardization characteristic of other industries? It appears to apply fairly well to the mechanical engineering industries producing consumer goods like bicycles and cars, but would it apply to the same extent to a large range of different industries?

The conclusions of Chapters 2 and 3 to the effect that the trend is driven by the desire on the part of producers to improve their products, to produce them more efficiently and to sell them more effectively, plus the preference of consumers for the familiar product of known reliability, suggest it should.

2. Studies relating to the more mature stages of industry development.

The most interesting question here is the degree to which the trend to standardization varies throughout the

life of an industry. Once an effective long-term standard has been established is it likely to survive indefinitely or will it eventually be replaced by something radically new, and if so, what are the necessary conditions for such a change?

3. Further work on the concepts themselves.

It would be particularly interesting to examine the relationship between FES, the role of design for functional efficiency, and PES, the role of production methods, in developing industries. This was not possible in the research because production methods in the motor cycle industry remained at a relatively primitive level during the period covered, and there was little indication that products were ever designed at that time with particular reference to production methods. One of the questions which arises here is what are the factors which encourage the earlier development of interaction between FES and PES?

Further work on the role of the different phases of industry development should also be worth doing. Greater awareness of the importance of phases could provide useful information in a developing industry as to the degree of risk for firms entering the industry and what kind of product should be developed at a given time.

For example, the computer industry in recent years seems to have been suffering from similar problems to those of the early motor cycle industry. There have been too many different products, competing technologies, and too many firms in the industry. The result has been overproduction with many firms getting into difficulties and some dropping out. Further work on the phase question might eventually help to reduce these difficulties or it might simply demonstrate that all industries have to go through such a period of chaos before the emergence of a standard product and a consolidated industry.

Product Development and History

This research has been very much a study of product development, particularly in attempting to apply modern concepts to an historical situation. In its emphasis on the interaction between technology and consumer satisfaction it represents what might be called a product development approach. But product development is not a constant and as a new industry develops from one stage to another the approach to product development itself is likely to change. There remains therefore one major question that deserves further examination: Did the industry's orientation to product development change significantly during the period studied? This is the subject of the final chapter.

CHAPTER 14

CONCLUSIONS (2): PRODUCT DEVELOPMENT

In its general design and layout, the thesis has been presented as a study in product development. It has followed the history of the motor cycle from its earliest days as an experimental vehicle through its troubled beginnings as a commercial product, to the period when for the first time it became commercially viable. Critical in the development of commercial viability was the emergence of a relatively standardized product, but what else did commercial viability mean and what were its consequences for the approach to product development?

It may be argued that as soon as the industry had succeeded in developing a product that was reasonably satisfactory from a consumer point of view, it should have shifted its primary attention from product technology, the development of better products with higher performance, to production technology, the development of more efficient means of production. More efficient production technology would be expected to simplify and speed up production, reduce costs, and ultimately reduce prices. In theory at least, lower prices should result in increased sales so that the expanding output would be rapidly absorbed. As a further contribution to this new wave of expansion in the industry, it might be expected also that standardization would cease to be simply an almost accidental consequence of the drive to functional efficiency of the product and become an active policy on the part of the producer in the interests of greater production efficiency.

If such a policy had been adopted by manufacturers not only would the industry have been shifting its priority from product to production technology but we would expect to find greater attention being given also to marketing so as to dispose of the increased output. Marketing policies

themselves would be expected to change so as to emphasize the advantages of lower price and simplified, standardized products.

The adoption of such policies would have represented a complete reorientation of product development in the industry and a decisive transformation in the industry's character. It would have marked the beginnings of genuine maturity.

This did not happen before the first world war. Why it did not happen is the subject of this chapter which considers the issue in terms of three main topics: production technology, prices and marketing. As we shall see, conditions in the industry did not lend themselves to the adoption of new production technology as soon as it became possible in theory; prices went up when, to judge by the above arguments, they should have been going down; and marketing remained much as it had always been in the industry although it was given more attention. Also, we shall find that the trend to standardization began to weaken at just the time when it should have been strengthening, because instead of adopting more active standardization policies producers turned again to product innovation.

Introduction

One of the main problems of dealing with the various issues which are relevant here, is lack of data. Product development orientation is hard to judge without data about decision-making processes concerning product selection and design within the firm, and this is almost entirely lacking. As was pointed out in Chapter 1, however, it is sometimes possible to infer something about the nature of the firm from the nature of its product. The discussion which follows is based on such inference and may go some way to remedying the lack of data about firms.

In the earliest days of the industry product development was quite clearly oriented towards functional efficiency, that is the technical development of the product. What exactly would it have meant if this orientation had

changed towards either production or marketing?

A production efficiency orientation means giving priority to production possibly at the expense of other considerations. Thus the main issue in design may become not product performance nor appeal to the consumer, but how to modify the product so as to facilitate production and reduce costs and ultimately price. There are periods in the history of an industry when such a strategy will pay provided certain conditions are met. The most essential of these are that a product that was initially of poor quality has been proved sufficiently effective to the consumer for it to develop a widespread appeal, and that consequently the market is expanding or likely to expand.

The functional efficiency orientation is the simplest from an organizational point of view in that it gives priority to product engineering. In comparison, the production orientation is rather more complex as it involves the whole of the production organization as well as the design department, the latter now being subordinated to the former. The marketing department is also likely to be subordinate and relatively undeveloped within such an arrangement as a result of the assumption, usually implicit in the production orientation, that lower price is the major factor in increasing sales. Thus its range of operation may be limited to sales promotion alone rather than marketing in its wider sense. It is the idea of marketing in its wider sense that applies when a firm adopts a marketing orientation.

Marketing used to be equated with selling, that is, sales promotion, advertising, and setting up distribution networks through the appointment of agencies, and many people and, unfortunately, many firms also, still talk about marketing when they really mean selling. Today, marketing means much more than this. In its most advanced form the emphasis is placed on the consumer and what he wants to buy rather than on the product that the firm wants to make and how to sell it, which tends to be a result of both functional efficiency and production orientations.

Marketing begins therefore not with taking a finished product and trying to sell it, but much further back than that before the product has even been designed, that is with a screening process intended to evaluate new product ideas as to their viability in the marketplace. It continues through product development which takes into account all the issues of design and production, quality and price, and the necessary trade-offs between them, so as to arrive eventually at a product which will have the widest possible appeal to the prospective market. Only at the end of this process does it become concerned with distribution and selling. Thus effective product development with its insistence on matching the product from a technological point of view with the market in the form of consumer needs, is at the core of modern marketing thinking.

Marketing in this form is a fairly modern development and we would not expect to find that it was practised in the British motor cycle industry before 1916. In its weaker, more traditional form as sales promotion, marketing certainly did apply and it will be discussed as such, in a later section. The main question that needs to be considered therefore is not marketing, but whether the industry did in fact take a decisive step towards production orientation before 1916. As already indicated above, there are three major issues to be discussed here: production technology, prices, and marketing in the form of sales promotion.

Production Technology

Up to 1900 the British motor cycle industry was made up largely of imitators of the de Dion. The majority of British firms which produced de Dion copies sold so few machines that considerations of production efficiency could hardly have entered into the reckoning. In fact, the problems of the new technology were probably so great for newcomers to the industry that most of them would have been fully engaged in getting their products to work at all; that is with the functional efficiency aspect, rather than

production efficiency.

The situation changed little during the development phase, 1901-7, since the emphasis was necessarily placed on improving the product for reasons which have already been discussed extensively in the main body of the research. There was, nevertheless, at this time increasing scope for the adoption of more efficient production methods from improved factory organization to increased standardization of components as a result of the installation of more modern machinery.

The Rex letter reproduced in Chapter 8 (p. 162) suggests that motor cycle firms were beginning to think along these lines, but Rex was then the largest producer of motor cycles with an annual output of perhaps a thousand or more. In comparison, the majority of firms in the motor cycle industry had outputs of no more than a hundred or so machines a year, that is no more than two a week, and for them it may not have been economically practicable to invest in expensive new machinery. The exceptions were firms already established in the cycle industry where such machinery could be used both for cycle and motor cycle manufacture, and the larger of these firms may well have invested in more advanced machinery already.¹

Thus for most firms the gains to be achieved by increased attention to production efficiency were still problematic. Although progress was being made, the emphasis up to 1907 remained on functional efficiency with probably no more than a few firms making the first tentative steps towards a more production oriented approach.

The most important change in the industry occurred after 1907 as Triumph machines came increasingly to the fore and promised better things for the future. Output for the industry as a whole does not seem to have increased significantly, however, until 1909-10 when several major firms entered or re-entered the industry. As some of these newcomers offered machines which were almost identical to the Triumph and which needed little improvement in order to ensure reasonable sales, it was possible for the first time

at least in theory for a firm to become thoroughly production oriented. Outputs of upwards of a thousand machines a year and a rapidly expanding industry, meant that something approaching volume production might be possible in the not too distant future. This being so, there were many ideas afoot that might have facilitated more efficient production, lower prices and a rapid expansion of output if the market could be found to absorb it. There is little evidence, however, that anything like this happened as a result of increased attention to production efficiency.

If there had been a significant change in orientation away from functional efficiency and the technology of product design towards production efficiency, we would expect it to be demonstrated in various ways. First there should be a conspicuous increase in the adoption of new production technologies, which should result not simply in increasing output but also in lower prices particularly for the firms with larger outputs, and relatively higher prices for smaller firms producing similar products. Alternatively, if prices do not fall we would expect a substantial increase in profit per machine sold. Finally, we would expect rather less attention to be given to product innovation and the development of technologically new models than previously. Production technology is discussed in more detail in the appendix to this chapter and the following paragraphs aim only to examine some of the more important points.

There are three main approaches to improving production efficiency that could have been relevant at the time: the installation of automatic machinery capable of producing accurately machined (that is, interchangeable) parts at reasonable speed; the design of products and product components so as to make them as simple to produce and assemble as possible without sacrificing the functional efficiency of the finished article; and improved factory layouts leading ultimately to the installation of line assembly.

The first of these was anticipated in theory in the

eighteenth century and achieved in practice at the beginning of the nineteenth. Such machinery was not installed in much of British industry until very much later, but it did become generally available in the second half of the century and was installed by firms in the motor cycle industry provided their output justified such an investment and they could obtain the necessary capital. Thus it is reasonable to believe that major firms were equipped with labour-saving machinery before the expansion of production dating from about 1909, and it was very likely the possession of such machinery that enabled some firms to survive the depression of 1905-8 by reducing costs, while others, probably those less well equipped, dropped out. This would account for the apparent fall in prices during the same period which is discussed in the following section.

The second question has already been discussed to a limited degree in the last chapter and it must be repeated that there is no evidence that motor cycle components were ever designed at that time specifically so as to simplify production. In view of the evidence of the Boston Report (1975) which criticized the industry for failing to adopt this approach in much more recent times, it is very unlikely that any such step could have been taken so early. Neither were complete motor cycles designed in this way though the idea had been established in principle and put into practice by Henry Ford.

The first indications of improved factory layouts in the cycle industry date from about 1896, but this aspect of production was not put on a fully scientific basis until after 1910 with the development of industrial engineering and time study.² One of the first significant developments towards the adoption of such ideas in the motor cycle industry was the new AJS factory built about 1915. In the AJS factory materials progressed through the building from one end to the other so as to reduce the time spent on materials handling. It was a substantial improvement on earlier "progressive" layouts in which materials although

travelling in the same general direction might zigzag from one side of the factory to the other, and thus it was an important step towards line assembly.

Line assembly was possible in theory for motor cycle production before the war, given the example of Henry Ford, but it would not be realized in the industry until many years later. Meanwhile, assembly was carried out by mounting the motor cycle frame on some kind of stand in an assembly room, and all parts were brought to that room from the various workshops in which they were originally manufactured. BSA, in 1928 possibly the largest motor cycle manufacturer, was still using the same method of assembly because of the difficulty of introducing line assembly in their factories.³

We are left with the conclusion then that apart from the adoption of new machinery which had begun in the 1890s, it is unlikely that most of the developments in production technology that were available to the motor cycle industry at the time were actually applied soon enough to have any significant effect on output and prices up to 1916. But even if more attention had been given to new production technology, how effective would it have been?

In many ways the industry was still oriented to increasingly out-of-date craft technology, and to attitudes rooted in the past and which emphasized quality rather than cheapness and considered the new high-speed machinery synonymous with shoddy goods. It was generally considered more desirable to maintain quality than increase output. As will be seen in the Appendix to this chapter, when BSA commenced production of complete bicycles in 1909, they raised the price as compared with the identical machine produced by local dealers using BSA parts, so as to emphasize the quality of their own product.

For similar reasons, Triumph failed to expand output fast enough to meet the demand for their machines: "they recognise that they cannot adequately deal with such a demand by running up new works, the element of skill and acquired art can only be extended slowly, and so we see the

company turning away orders rather than, for an immediate profit, jeopardizing their name for good quality".⁴

This would suggest that the problem was not simply a preoccupation with quality but also a genuine lack of skilled labour which, given the extremely rapid expansion of the industry after 1908, would not have been surprising. The alternative solution to restricting output might have been to install more automatic machinery so as to simplify production and reduce the necessary element of skill. Whether changes of this nature could have been achieved without turning the standard Triumph motor cycle into quite a different product is problematic, but it is doubtful if Triumph could have succeeded with such a policy given not just commercial attitudes and working practices in the motor cycle industry itself, but also the traditional forms of work and work organization which prevailed in British industry as a whole. The organizational problems of British working practices outlived the motor cycle industry.

Clearly the industry was too much rooted in tradition to enable it to take the decisive step towards a more production oriented approach to product development. However, more advanced machinery was gradually being adopted, but there is little evidence of a more scientific approach to standardization either of components or of the finished product. Progress was being made in terms of improved factory layouts, but the problem here was as always that the ideal layout can rarely be achieved without building a new factory. The idea of building a new factory was apparently rejected by Triumph even when demand for their machines was more than they could meet, which suggests that very few firms could have felt justified in doing so.

Consequently the expansion of output was probably slower than might have been the case, and it is hard to see anything in the nature of economies of scale being achieved in such an environment. The trend of price movements supports this conclusion.

Prices

Despite the industry's apparent failure to take the maximum advantage from new developments in production technology, production methods did improve and outputs did rise. Was there sufficient improvement overall to result in lower prices?

In fact, prices did not fall to any noticeable extent at the time when we would expect them to have fallen, that is after 1908. Before then they appear to have moved in a rather eccentric way. In earlier days until about 1904 or 1905, prices tended to be relatively high.⁵ Then they began to fall until about 1908 when they began to rise again until they levelled out between 1910 and 1912 after which they stayed more or less constant until the war.

Prices of early machines were often high because the technology was still new and firms entering the industry still had to undergo a kind of learning process before they could achieve anything like an efficient production organization. Thus the very simple Minerva type machines of 1901-4 could cost £50 or more.⁶ Prices did tend to fall from then on, however, and at the end of 1908 it was noted that prices of typical machines had fallen £5-£10 in three years.⁷ Now from 1905 to 1907 the industry was contracting perhaps to half of its former size so it is hard to see how the fall in prices could have had anything to do with economies of scale. What probably happened was that during the depression in the industry firms had to cut prices in order to survive so that the less efficient producers were driven out.

This downward trend of prices was short-lived, however, and with the upturn and increased production, prices began to rise. In 1909 Ariel advertised an increase in price of their 3½hp model "owing to extraordinary demand" and the "great cost of manufacturing such a high class machine".⁸ Let us consider this point against data for a number of firms.

In examining price data for the industry as a whole as presented in "The Motor Cycle Buyers' Guides", the major

difficulty is to find a reasonable number of machines with identical specifications. For this reason the numbers of machines in the following data are relatively small compared with the total number of different models on offer, and represent in effect the particular product class rather than the whole industry. Nevertheless, the price situation in the remainder of the industry was not significantly different.

The prices examined are for machines which were similar in specification to the Triumph. This does not mean that the machines in question were identical since minor differences of technology and finish would not have been recorded in the buyers' guides but could have accounted for differences in price.

In the 1906 guide it was possible to find only six machines with approximately similar specifications to the Triumph. The average price of these was £37, against the price of a Triumph of £43 (see Table 14.1).

	1906	1908	1910	1913
Triumph	43	48	49	60
Average price of similar machines	37(6)	39(14)	46(23)	57(12)

Table. 14.1. Triumph Prices Compared with those of other British-made 3½hp single cylinder machines (3hp for 1906), 1906-1913.⁹

(Numbers of machines in brackets. All prices rounded up.
Specifications of Triumph and similar machines:
1906 - 3hp, single cylinder with mechanically operated inlet valve, belt drive and single speed;
1908 and 1910 - as for 1906 except for 3½hp engine;
1913 - as for 1908 except for the addition of three-speed hub gear.)

In 1908 the average price of 14 similar machines was

£39 against the price of a Triumph of £48. By 1910 the average price of 23 similar machines had increased to £46 against the Triumph price of £49. In 1913 with a significant change in technology arising from the adoption of variable speed gears, the average price of 12 similar machines was £57 against £60 for the Triumph.

Thus from about 1908 there was a tendency for prices of non-Triumph products to converge towards the price of a Triumph which itself remained relatively constant. Where then does the question of economies of scale come into all this? There is little evidence that it had any significance whatsoever. If firms in the industry had been experiencing economies of scale, the products of the smaller firms would have been rather more expensive than those of the larger firms. But as we have seen, Triumph, the largest firm, sold their products at above average not lower prices, and several much smaller firms were producing similar machines that were rather cheaper.

Economies of scale might have been achieved as production increased as a result of the larger discounts earned on increased orders for raw materials and proprietary components, but was the scale of production yet large enough to generate sufficient savings to allow significant price-cutting? Again the answer is probably not.

If we look at Triumph's profits for 1913, £66,383,¹⁰ and compare them with their motor cycle output, probably between six and seven thousand, then they could not have been making more than about £10 profit per machine sold. Very likely this figure should be lower, however, because of profits from their other operations.¹¹ Thus a cut of £5, that is about 10%, on the price of each machine, would have reduced their profits by half. In order to justify such a cut they would have had at least to double their total sales. This would have been very unlikely since, as has been pointed out elsewhere, a price difference of up to 10% between models has little effect on sales,¹² and at £5 less than its original price the Triumph would have not been significantly cheaper than comparable models.

If, however, they had been able to achieve a substantial increase in output, they might have significantly improved their production efficiency, they might have achieved economies of scale, and thus have been able to maintain or increase profit per machine even at a lower price. But, as we have already seen, their working practices would have made this improbable and suggest that Triumph was neither able nor willing to increase output at an accelerating rate.

Finally, there is one other issue which may have been of significance. The price of a Triumph remained almost constant between 1908 and 1912. If at the same time production costs had risen then the price must have fallen in real terms. There is no cost data available for the motor cycle industry at this time, but we can consider the question from the point of view of the cost of living in general and wage levels. The cost of living in the United Kingdom rose about 7% from 1908 to 1912, but money wages in industry increased by only 2%.¹³ Such figures do not suggest the probability of any large increase of costs in the motor cycle industry which could well have risen no more than 4-5% and perhaps less. An increase of this order would have put only about £2 on the price of an average machine, not enough to have been of much significance or to indicate that Triumph had made any great step forward in terms of economies of scale by keeping prices almost constant.

Thus while we do not have detailed firsthand accounts of productive operations within firms of the time, what data there are suggest either that there was little in the nature of economies of scale in the motor cycle industry before the first world war, or that if such economies were achieved they were not likely to have been great enough to have had much impact on prices to the consumer. In fact the evidence is quite conclusive that prices did not fall during this period.

It remains to be considered what options if any manufacturers had to cut prices at this time. Almost

certainly, given the existing price-cost relationship in the industry it is doubtful if they would have gained anything simply by cutting their prices. There was a substantial prejudice in the industry against price-cutting but there is no reason to believe that this was irrational from a commercial point of view. Previous experience had indicated that cheaper products were almost invariably of poorer quality and that firms that did offer good products at low prices often got themselves trouble. Thus price-cutting alone was not enough.

The way to cut prices successfully was first to upgrade the technology so as to simplify production and reduce costs. It is doubtful if such a policy would have been possible except for the largest producers, but as we have seen even for these it may not have been practicable or justified to adopt the most advanced technology. The scale of operations was probably not large enough to justify building new factories simply to improve production efficiency, while existing factories did not usually lend themselves to the ideal layout. Thus although attention was given constantly to improving production efficiency the results were likely to have been far from optimal and, as we have seen, prices tended to rise rather than fall.

How might we account for this tendency for prices to rise? Was there anything in the nature of a consistent pricing policy in the industry at this time? There is little relevant data on this question, but what data there are suggest at least the possibility of a variety of pricing policies across the industry as a whole.

Triumph, in view of the demand for their machines, was perhaps in a position to charge a premium price for their machines over and above what would have been indicated by full cost plus normal profit. However, the fact that the prices of their machines remained relatively constant at a time when their sales were increasing, suggests that they did not do so.

When BSA first entered the industry they priced their machines about £2 higher than the Triumph. This may have

meant a continuation of the pricing policy adopted in connection with their bicycles discussed above, or it may mean that their costs were higher because they were new to the industry. Certainly, however, such a firm could trade on its reputation.

Against this the industry's history does give some examples of price cutting and it seems very likely therefore that some firms continued to accept lower than normal profits in order to keep prices down so as to maintain their competitive position.

There is little evidence, however, of firms doing particularly well as a result of offering cheap machines. We may note, in this context, that the Douglas was a good deal cheaper than the Triumph when first introduced, and Douglas was the only firm which began to rival Triumph in terms of output. But their prices rose even though their output was increasing rapidly.

It is possible that prices rose because the demand for motor cycles exceeded the productive capacity of the industry. The Ariel comment about "extraordinary demand" indicated above suggests this possibility and very likely it provides part of the answer. But it is unlikely to be the major part given that Triumph prices remained virtually constant through the period in question. Ariel's other remark about the "great cost of manufacturing such a high class machine" is likely to be rather more significant in that it suggests that the tendency for prices to increase represented the general improvement in overall quality and technology.

This general improvement may well have helped to bring the average machine up to something approaching the standard of the Triumph: "The season that has nearly passed has seen a remarkable growth of the motor cycle business... At the same time we have not been treated to any revolutionary innovations. It may be said that nothing stands out as one great improvement. Rather there has been a levelling up of design and equipment to something nearly approaching a standard of design from which there are few

radical departures."¹⁴ And it would appear that not only was there emerging a product of standard technology, but also of standard price which would explain why the prices of non-Triumph machines tended to converge towards that of the Triumph..

From about 1912 onwards in addition to the levelling up of technology there was also a strengthening drive towards product innovation per se. As discussed in Chapter 10, the fact that many firms produced what appeared to be a close copy of the Triumph does not mean that this strategy was universal. Several firms produced entirely innovative models at this time including ASL, Douglas, James, Scott and Wilkinson. Others like Rudge, entering with a machine which was rather similar to the Triumph in general format, devoted a great deal of time and money developing an entirely new engine for the machine and one which represented one of the most expensive technical developments in the industry so far.

These developments in general indicate that the standardizers were far from having everything their own way. The new technologies were having an increasing influence on more standard products, so that after perhaps no more than two or three years during which firms could do well just by imitating the basic Triumph, they again had to concern themselves with new product technology in order to stay in business. Clearly the period in which product technology was the most important issue for the industry was far from over.

This renewed interest in product innovation took place at just the time when we would have expected to find evidence of greater efforts towards standardization, especially if the trend to standardization had evolved into a deliberate policy. Thus it would seem to apply the final coup de grâce to any suggestion that the industry was at last shifting its priorities towards production efficiency, and it is apparent therefore that any significant move towards a more production oriented approach was still in the future. Data about marketing strategies and the

approach to sales promotion offer little evidence to contradict this view.

Marketing

As we have already seen there is little evidence to suggest the adoption by firms in the industry of a more active policy towards standardization, cost reduction and production efficiency between 1908 and 1916. And even if such a policy were adopted it almost certainly failed since although output increased during this period, prices also increased when we would have expected them to fall. A necessary adjunct to such a policy would have been a more active approach to marketing and particularly sales promotion.

Sales promotion in various forms was no new idea to the motor cycle industry. It was established in the cycle industry many years before the first motor cycle was produced, taking the form of advertising, publicity stunts, displays at the annual cycle shows, and the development of agency networks.

The scanty attention given to sales promotion in the earliest years of the motor cycle industry demonstrates the general lack of confidence in the product. Most of the early producers never advertised in the motorcycling press and neither did they send their products to the annual cycle shows. What output they were able to dispose of was probably sold through local dealers.

From about 1901, however, with the development of such machines as the Minerva and the Werner, the position changed and large numbers of firms began to send their machines to the annual shows. But there were now so many firms in the industry, over a hundred, attempting to compete for an extremely limited market, that neither a show appearance nor "straight" advertising was enough. Rather more was needed in order to catch the eye of the consumer with the result that the period became virtually the age of the stunt.

The idea of sales promotion stunts was at least as old

as the cycle industry in which long distance record breaking was a popular activity. For the motor cycle industry the pattern for much future sales promotion was established by Egerton's run from Land's End to John-o'-Groat's on a Werner in 1901, the first of many "End-to-End" runs. van Hooydonk failed in his attempt to emulate this performance on his Phoenix, but did rather better on the race track. BHD set a new trend by his two hundred miles in a day on an Excelsior in 1903, and substantially surpassed this performance in covering two hundred miles a day for six consecutive days on a Triumph in 1905. Not all of these performances were necessarily promoted by the manufacturers for sales promotion purposes as was the case with the last mentioned, but they served as very good advertising, nevertheless. Performances in competitions served at least as well and soon firms like Triumph were employing people to ride for them.

The most spectacular sales promotion efforts, however, were those by such firms as Noble who offered advanced specification machines at very low prices, and Rex with their very high trade-in offers.¹⁵ These were effective for a time, but Rex eventually got into trouble as a result and Noble did not survive long enough to enjoy the prosperity that was to come. Sales promotion alone was not enough to consolidate the market. A better machine was still required and only when that had been achieved would sales begin to grow significantly. No amount of sales promotion can sell a poor product.

The overproduction of rather poor products was almost certainly the cause of the depression in the industry from 1905 to 1907. But out of that depression Triumph emerged as the major firm in the industry and their product rapidly became the industry standard which was soon widely imitated. The Triumph was a popular choice and its success probably owed at least as much to its quality, performance and reliability as to any sales promotion effort on the part of the firm: "So we arrive at the point that the successful motorcycle is really designed by the public

themselves, the manufacturer's duty being to solve the 'problems of compromise,' which result in the endeavours to combine comfort, appearance, weight and price".¹⁶

The development of a popular standard with the result that machines across the industry as a whole tended to look increasingly alike (see fig. 14.1) might have generated a new problem for marketers, but the situation was still far from that which developed in the motor industry in the 1920s when cars were so much alike that they had to be differentiated by styling and other purely cosmetic modifications.

British motor cycles were always beautifully painted and finished off by hand almost to the standard of a work of art, but this was part of the craft tradition rather than a marketing exercise. In any case there was no need for "empty" product differentiation when there was so much new technology still to be applied that any producer who wanted to increase the attractiveness of his machines only had to add a new technical feature ahead of his competitors such as, for example, a kick-starter or an improved variable gear, in order to get the consumer's attention.

Advertising matter tends to confirm this view since it concentrated overwhelmingly on technical features and performance. An analysis of 11 display advertisements in "The Motor Cycle" for 8 April 1903, found that 7 emphasized technical details and 3, convenience of operation or performance. A similar analysis of 15 display advertisements in the same journal for 2 May 1904 found that 5 emphasized technical details, and 7 emphasized performance either in terms of speed, hill climbing, etc., or competition success.

In later years the emphasis was overwhelmingly on performance. In "The Motor Cycle" for 6 May 1908, of 25 advertisements, 11 placed the emphasis on performance in general, 6 on competition success, and 8 on technical features. In the issue of the same journal for 2 May 1912, of 31 advertisements no fewer than 18 put the emphasis on competition success or record breaking, 9 on performance in

general and the remaining 4 on technical or other issues.

Thus as the motor cycle was improved and became more reliable, the emphasis in advertisements gradually shifted away from technical issues first to performance in general and finally to competition success. Except for rather untypical machines, no attention was ever given to the superiority of a particular design even when the Minerva and Werner types were still apparently in competition with each other in 1903. Price was rarely emphasized, was sometimes buried in the small print, and sometimes left out altogether. Curiously, an advertisement for the Ariel stated that "the price is right" but did not give the price.¹⁷ The trade-in offer campaign run by Rex and discussed in Chapter 8, was unique to them, and the ostentatious price-cutting advertised by Noble was similarly unique. No advertisement examined gave any attention to superficial features like colour schemes or styling as might be the case today.

There is no evidence that advertising would sell a machine that people did not want to buy. The Binks machine was advertised on a lavish scale with full page advertisements (fig. 8.7) yet it did not sell and soon had to be withdrawn. Much the same could be said about other untypical machines like, for example, the various "bicars" and later machines like the James, and the Roc. Advertising might convince the consumer that one machine was better than another but only so long as it was conventional in format and reasonably up-to-date in technology and preferably also a good performer on the race track. The new technology machines which did sell well like, for example, the Douglas and the Scott, achieved their success in competitions first before large numbers of people would buy them. There is no indication that their initial acceptance owed anything to advertising.

Sales promotion stunts continued much as before in the form of "epic" rides, but were gradually surpassed in significance by racing performance particularly after the establishment of the TT in 1907. A win in the TT was the

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Then pay us a visit to see our great selection of the newest, most up-to-date Models of every first-class make staged side by side for your convenience to enable you to observe and compare the good points of each make and every model. That's the way to make a satisfactory choice.



TRIUMPH 1911 MODELS.
Roadster Model, 4 1/2 h.p. ... £48 15
Free Engine Model, 4 1/2 h.p. ... £55 0
T.T. Roadster, 4 1/2 h.p. ... £50 0
T.T. Racer, 4 1/2 h.p. ... £50 0

Second-hand Triumph Motorcycles for Sale.

GET WAUCHOPES' LIST FOR BIG VALUE.

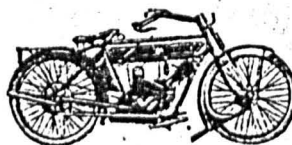


ZENITH 1911 MODELS.
4 1/2 h.p. Gradus Gear ... 52 guineas
6 h.p. Gradus Gear ... 68

Second-hand Zenith Motorcycles for Sale.

Complete Price List of New and Second-hand Machines sent on application.

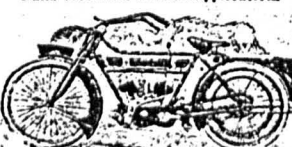
OUR SECOND-HAND MACHINES OVERHAULED, RENOVATED AND FULLY GUARANTEED ARE, GENERALLY RECOGNISED AS LONDON'S MOST SATISFACTORY MOTOR BARGAINS.



PHYLON & MOORE 1911 Models.
4 1/2 h.p. Solo or Sidecar machine ... £58 10
4 1/2 h.p. Colonial model ... £60 0
2 1/2 h.p. Light model ... £48 10

Second-hand P. & M. Motorcycles on Sale.

Complete Price List of New and Second-hand Machines sent on application.



ROYAL ENFIELD.
2 1/2 h.p. Royal Enfield ... 41 gns.

NEW HUDSON.

NEW HUDSON MOTORCYCLES.
2 1/2 h.p., 33 speeds, 45 gns.

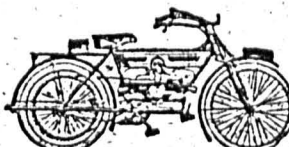
Telephone: 5777-Holborn.



REX 1911 MODELS.

4 1/2 h.p. ... 43 gns.
5 1/2 h.p. Rex de Luxe ... 60 gns.
7 h.p. Rex de Luxe ... 75 gns.
5 1/2 h.p. Rex Sidette Models ... 70 gns.
7 h.p. Rex Sidette Models ... 80 gns.

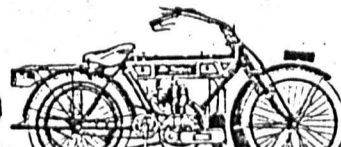
Second-hand Rex Motorcycles for Sale.



DOUGLAS 1911 MODELS.

2 1/2 h.p. Model D ... 38 gns.
2 1/2 h.p. Model D, 2 speed & pedals ... £46 0
2 1/2 h.p. Model E, 2 speed gear, foot boards and starting handle ... £48 0

Second-hand Douglas Motorcycles on Sale.



BRADBURY 1911 MODELS.

4 1/2 h.p. Single Speed ... £48 0
4 1/2 h.p. Free Engine ... £54 10
4 1/2 h.p. 2 Speed ... £55 0
Side car ... £10 0

Second-hand Bradbury Motorcycles.

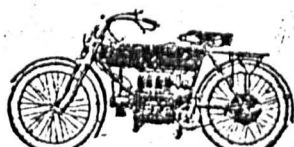
GET WAUCHOPES' LIST FOR SURE SATISFACTION



MATCHLESS 1911 MODELS.

4 1/2 h.p. ... 53 gns.
6 h.p. M.O.L.V. ... 54 gns.
8 h.p. ... 64 gns.
2 Speed Gear, extra ... 12 gns.

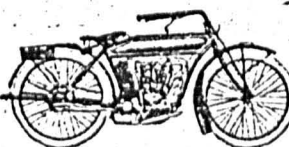
OUR NEW MOTORCYCLES ARE THE MOST SATISFACTORY PRICE BARGAINS OBTAINABLE. DOUBLY VALUABLE BECAUSE SO PERFECTLY TUNED UP AND PREPARED FOR ROAD WORK BY OUR OWN EXPERTS.



F.N. 1911 MODELS.

5 1/2 h.p. 4-cylinder ... 50 gns.
2 1/2 h.p. shaft-driven Lightweight ... 45 gns.
Second-hand F.N. Motorcycles on Sale.

GET WAUCHOPES' LIST FOR VARIETY OF CHOICE.



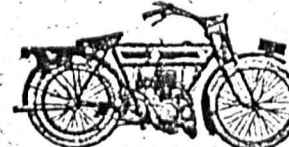
INDIAN 1911 MODELS.

4 h.p. single cylinder, free engine clutch ... £55 10
4 h.p. single cylinder, two-speed gear, F.E.C. ... £48 10
5 h.p. Twin Free Engine ... £53 10
7 h.p. Twin, Free engine and two-speed gear ... £75 10



HUMBER 1911 MODELS.

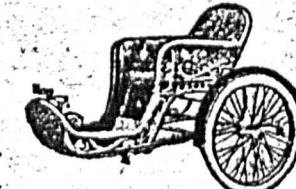
4 1/2 h.p. 2 Speed model ... £50 0
4 1/2 h.p. Single Speed ... £45 0
2 h.p. Lightweight ... £37 0



PREMIER 1911 MODELS.

4 1/2 h.p. Tonlist ... £47 0
Free engine clutch extra 7 guineas.
2-speed gear, extra 10 guineas.
4 1/2 h.p. Twin-cylinder, with 2-speed gear ... 62 gns.

SOLE CITY AGENCY FOR ALL BEST MAKES: CASH OR EXCHANGE.



HERALD WICKER SIDE-CAR.

Fits any Model. Delivered from stock, £6 16 0.

Guaranteed to satisfactorily fit all known makes of Motorcycles.



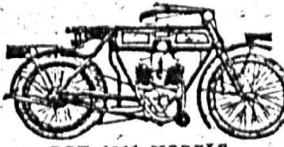
KERRY ABINGDONS.

4 1/2 h.p. Standard Model ... 43 gns.

You can get them at WAUCHOPES'.

Cash or Exchange

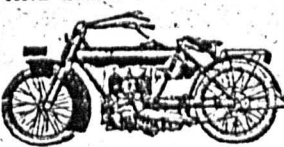
Complete Price List of New and Second-hand Machines sent on application.



BAT 1911 MODELS.

5 1/2 h.p. ... £58 0
7 h.p. ... £60 0
2 speed Gear & Free Engine, 10 gns. extra.
Second-hand Bat Motorcycles for Sale.

GET WAUCHOPES' LIST AND SAVE YOUR £ s. d.



CHATER LEA 1911 MODELS.

8 h.p. No. 7, 8 Speed Models, J.A.P. eng nes ... 76 gns.
Second-hand Chater Lea Motorcycles on Sale.

ASK FOR LIST

L.M.C.

L.M.C. MOTORCYCLES.

4 1/2 h.p. adjustable pulley ... £48
4 1/2 h.p. F.E. pulley ... £50

Telegrams: "Opifcer, London."

EVERY MOTORCYCLE IN OUR SHOWROOM BEARS ITS NUMBER AS SET OUT IN OUR DAILY LIST. STUDY THE LIST, SELECT YOUR NO.

THEN CALL

9 SHOE LANE
FLEET STREET LONDON E.C.

OR WRITE

Fig. 14.1. Wauchopes

("Motor Cycling", 1 August 1911)

best possible publicity and the most effective stimulus to sales. It not only increased orders but also increased interest among prospective agents,¹⁸ and consequently firms began to devote an increasing effort towards racing success.

Firms which lacked such success must have found it difficult to establish agencies so as to expand sales particularly when they came into competition with such large, long-established firms as BSA whose agency network, the result of long experience in the cycle industry, must have been a major factor in their being able to sell all of their first year's output of a thousand machines without difficulty.

Very likely sales were stimulated also by the development of larger retail outlets like Wauchopes of Shoe Lane off Fleet Street (fig. 14.1). All of these developments would have favoured the larger firms at the expense of the smaller ones which may well have had difficulty in distributing their products. In Wauchopes' advertisement all of the machines illustrated are the products of well known, long established firms.

In sum, as the industry grew and particularly as motorcycling developed into an active sport, there was as would be expected a substantial increase in advertising and sales promotion in general. But there is little evidence from the nature of advertising and other forms of sales promotion that firms were becoming more interested in standardization as a cost cutting exercise or that they were having to adopt a purely cosmetic form of product differentiation in order to sell their machines in competition with the similar products of other firms.

The Step Untaken

The aim of this final chapter has been to consider whether and to what extent the approach to product development changed during the period covered by the research. It would seem likely that as the industry evolved the major concern in product development would shift from the initial

emphasis on product technology and the functional efficiency of the product, first to production efficiency and finally to marketing. Thus as the industry matured we would expect to find that the trend to standardization itself, although represented as somewhat in the nature of an autonomous economic force, would tend eventually to be reinforced by the conscious and deliberate adoption of a policy of standardization for the purposes of simplifying production and reducing costs. The application of such a policy would amount to one of the most significant steps the industry could take in its drive towards maturity. As we have seen this step was not taken during the period up to 1916.

The evidence that this step was not taken by the industry as a whole is almost as conclusive as it can be. The reasons are not quite so easy to identify, but the major one is probably that outputs even for the largest firms were still too low to justify major new investment in production facilities for the sake of improving production efficiency alone. The gains from economic standardization come initially from simplification, that is the reduction of model types and production of different models which are able to use as many common components as possible. In pursuing such a policy, that firm would gain most which could concentrate its entire output on a single model.

Triumph's early strength developed in this way. They concentrated their entire effort on developing a single model instead of dispersing it among several distinct types. By 1912 although sticking to the same type of machine, they had three models listed, a standard machine, what might be called a de luxe model which included additional features, and a racing model. Even if they had been able to concentrate their entire annual output of about six thousand machines on the one standard model it is doubtful if the gains in production efficiency would have been sufficient to facilitate a worthwhile cut in price—that is the kind that would have generated a big enough increase in demand for their machines to justify the exercise—unless

they had been sufficiently avant-garde to become one of the very first producers in the world to install assembly line technology.

But rather than move in this direction, Triumph, like most other motor cycle firms, tended to increase the number of different models they produced. They did substantial development work on a twin-cylinder machine which never went into production and late in 1913 they introduced a lightweight model. This tendency to increase the number of model types became characteristic of the industry and accelerated in later years. Faced with loss of sales in the early 1920s, BSA responded by widening their range so as to tap as large a segment of the market as possible. By 1963 they were producing 42 different models for a total output of only about 18,000. That is on average not much more than 400 machines of each type.¹⁹

When at last the industry began to produce some significantly cheaper machines, it was not the result of production economies but of new product technology. The development of the two-stroke engine enabled manufacturers to put on the market lightweight motor cycles of relatively simple design for not much more than £20, less than half the price of the popular standard types based on the Triumph. Indeed, in 1913 Veloce, inspired by the idea of a cheap 'Everyman's' machine, produced its first two-stroke model.²⁰ But the firm never became a large-scale producer and the cheaper, simpler machines never looked like supplanting the established standards at that time. Economic standardization together with its theoretical gains were a dead issue and the industry remained committed primarily to the product itself rather than the means and methods of production.

Marketing continued as the follower rather than the leader, the aim being to sell what people were believed or known to want rather than trying to persuade them to buy what the manufacturers wanted to sell. But the idea that marketing can re-educate public taste to the extent of selling goods people do not really want, is probably a myth

anyway. The message of much of the thesis is that people simply would not buy poor products or unanticipated innovations whatever the effort in terms of advertising and sales promotion.²¹ The aim of manufacturers therefore remained to improve the quality of the product and to upgrade its technology until it could do almost everything that consumers wanted.

The motor cycles of 1908 or 1910 or even 1912, were still somewhat short of this standard even in terms of the expectations of the day. An entirely satisfactory motor cycle from a consumer point of view, as compared with the typical machine of, say, 1912, needed to be improved by the replacement of belt drive by a chain, the addition of a three-speed countershaft gearbox rather than the cycle-type hub gears then in vogue, simpler starting in the form of a kick-starter, and a more reliable engine needing less maintenance and capable of going longer distances between overhauls.

Even allowing that motor cycles were now selling in fair numbers, it would be surprising to discover mass production technology and economies of scale in connection with a product which still needed substantial further development. In order to sell more motor cycles what was required was not just a high quality product but an even better one, one at least as good as the best machines produced immediately before the war, and this would have been difficult or even impossible to achieve at a cut price given the level of output at the time. Thus although mass production might have been possible in theory before the war, it is unlikely that it could have been achieved either in technological or commercial terms before 1925 or 1930 at the earliest, notwithstanding what was realized in the motor industry.

What was possible in car manufacture was well in advance of what might be achieved with motor cycles. Cars were always more advanced technologically than motor cycles partly perhaps because of their relatively high weight and size which facilitated the installation of new technology,

but more especially because of their relatively high price. The standard Model T Ford, despite being a simplified model, was relatively sophisticated when compared with the typical motor cycle of the day. Thus the Triumph was not to be compared with the Model T and the firm's policy to maintain quality rather than to raise output at the risk of lower quality, may well have been justified. The day of the mass-produced motor cycle was yet to come.

In sum, a significant move by the industry before the first world war towards economic standardization resulting in improved production efficiency and lower prices, although possible in theory was almost certainly impracticable given the constraints under which it had to operate. If fault existed it was not so much in the industry itself as in the prevailing industrial culture which precluded any speeding up of workpace, any fundamental change in traditional management and working practices. It is doubtful if even a Henry Ford could have changed this, but the British motor cycle industry never had such a man at any time in its entire history.

The lessons of more recent history confirm this view and we can put the situation more firmly in perspective by comparing it with the conclusions of the Boston report which described the state of affairs in the industry some fifty or sixty years later.

As far as design was concerned, this report, published in 1975, found that "What is lacking is the tight control of the design function and its close coupling to the requirements of marketing and production in order to produce integrated, cost effective models within reasonably short lead times". The production process was also found to be very much out-of-date: "The factories themselves contain mostly old, general purpose, fairly labour intensive equipment. At Wolverhampton, for example, as many as 60% of the machine tools may be more than twenty years old....." Finally, it was observed that "None of the existing British motorcycle designs is suitable for manufacturing using modern production techniques".²²

Although it would be unfair to judge the early motor cycle industry by modern standards, it is very likely that exactly the same criticisms would have been appropriate if they had been applied to the industry before 1914. Britain was in the lead but the seeds were already being sown for the loss of that lead.

Concluding Remarks

The research is now complete. It has followed a long and sometimes rather tortuous route, but it has succeeded in what it set out to do.

The trend to standardization has emerged as a major factor in the development of a new industry particularly where product development is concerned. The question of product standardization across the industry as a whole and the current status of the industry standard, are clearly of great significance for the success or failure of innovations. Product development is in fact a result of the interaction between the trend to standardization and the drive to innovate.

Innovations, when they are technically effective in what they are intended to do, fail for two main reasons: they either clash with the existing standard and yet are not of sufficient weight to replace it, or although apparently in harmony with the standard, are out of time. Products which are out of time can be either too early or too late, but features which can be incorporated within the existing standard resulting in significant improvement, will eventually be adopted. The highly innovative product which clashes to a considerable degree with an existing standard has a poor chance of success, and many major new product failures of recent times could probably have been avoided if the developers had taken notice of this fact.

Looking at the research as product development history, it is worth noting that although some of the ideas used, and particularly those of Chapter 3, are based largely on knowledge of present day business activity, they have proved no less relevant to the historical setting. There

seems to have been much the same division between the innovative minority and the conservative or cautious majority of consumers before the first world war as there is today.

APPENDIX TO CHAPTER 14

PRODUCTION TECHNOLOGY

Production technology has not been given any great attention in the main body of the thesis because, as has already been pointed out, it had little or nothing to do with the development of the trend to standardization. The key issue in identifying the trend as it has been defined, has been the degree to which a given product format was established across the industry as a whole. Concern then has been with the final product, not the part, and as has been made clear throughout the thesis this has never been a result of production technology, but rather of product technology and the response to it of the consumer. The development of the product in a particular direction depended initially on its functional efficiency and secondly on its general form, shape and appearance. It did not depend on production technology.

The standard product which emerged from the interaction between product technology and the consumer was a standard only in a rather broad and general sense. It was not a standard in terms of the kind of standard set up by standardization committees. There was only one such standard set up in the motor cycle industry before the first world war, and that was for wheels rims. Even in particular firms there was little tendency to set up one standard product which would have simplified production. Rather the tendency was to increase the number of different models. It may be that this was an opportunity lost, or it may be that the industry was not yet ready for the gains which might come from an increased degree of economic and technological standardization, either because outputs were not yet high enough or for some other reason. The account which follows is an attempt to consider these questions from the point of view of production technology in more detail than has been possible in the main text. It is, however, far from being a full treatment of the subject.

Steps in the Development of Production Technology

As we have seen in Chapters 2 and 13, there have been several major steps in the development of production technology short of the automation and robotics of modern factories. These include, and this list is not necessarily exhaustive:

1. craftwork to individual design;
2. craftwork to standard pattern;
3. interchangeable parts by automatic or partly automatic machines;
4. design of components and final product so as to simplify production;
5. standardization, particularly of the final product;
6. design of factory layouts so as to achieve maximum efficiency short of continuous flow assembly;
7. continuous flow assembly line.

1. **Craftwork to individual design** was largely superseded for larger-scale production long before the development of the motor cycle industry. It may well have survived, however, for small firms with very low outputs even to the days of the motor cycle industry, but it would have been of no great significance.

2. **Craftwork to standard pattern**, or something akin to craftwork, was perhaps characteristic of the smaller firms in the industry which could not afford modern automatic machinery, and no doubt accounts for the lack of interchangeability of parts that was complained about in some letters to the motorcycling press and discussed in Chapter 8, page 177. This type of technology was hardly characteristic of the major firms which led the industry's rapid growth after 1907.

3. The most significant technology applied to the production of motor cycles at this time was the use of **automatic machinery** capable of producing parts to a high degree of accuracy and fully interchangeable. Such technology was not new and had been introduced in the American armaments industry in the 1840s, and in the British

armaments industry in the 1850s and 1860s. Like much of British industry, the cycle industry lagged in this respect and did not begin to adopt advanced technology until the late 1890s. From then on we find reports of cycle and motor cycle firms which did use automatic machinery.

A report of a visit to the new premises of New Hudson was phrased in graphic terms: "Commencing on tour in the general machine shops, we found it necessary to thread our way very carefully through the perfect maze of flying belts and pulleys; this shop is a veritable hive of industry, and embraces all the usual operations for making the various component parts of the frames, hubs, etc. Most of the machine tools here are of massive construction, and include some of the most recent productions in automatic machinery, and not a few of the firm's own special design....."¹

Comparable reports can be found for many other firms including, Bradbury, which also manufactured machine tools for the industry, BSA, Components (manufacturers of the Ariel), James, Norton, Raleigh, Royal Enfield, Rudge, Triumph and others. There was a limit, however, to how much might be achieved simply by the adoption of new machinery. As will be seen later, much depended on how the machinery was to be used.

4. The design of components and complete products so as to simplify production and make the best use of production technology was one of the most important steps that could be taken towards the development of mass production techniques and the achievement of reduced costs. It would require that standardization be an active policy rather than a relatively passive following of the market standard. It is more important, however, to design products that are easy to produce from the point of view of machine operations and assembly, than merely to standardize them.

This was a step that was perhaps never fully appreciated or realized in the entire history of the British motor cycle industry. Even in the 1960s the industry still lagged in this respect, and yet there were some in the

industry who began to recognise the advantages of such a development in much earlier days.

One writer on the motor cycle observed that: "Within the limits of its design, and the demand for it in quantity, it is safe to say that it has now reached a point where it is difficult to cut down the manufacturing cost".² The call was for a new design with fewer parts in order to reduce costs. Elsewhere and a few years later, it was noted: "If he [the manufacturer] finds that the public demand he should supply a single-gearred machine, and a two or three-speed model, let him design his frame so that the gearbox can be added without any alteration. By doing this he can standardize everything; and standardization means economy".³ Such comments tended to be disregarded, or to come too late to have any significant influence during the period.

5. Greater attention to standardization of both component and complete machine was indeed a further step, the advantages of which were just being recognised: "British manufacturers appear to be far too fond of making a few of several types rather than concentrating on one pattern and sticking to it. The result of the former policy is that the costs of production are doubled, and the possibility of a rider obtaining the correct replacement for his engine when he requires one are few and far between".⁴ This is another policy which was not adopted either at the time or in later years when in face of declining sales, producers might attempt to maintain output by increasing the number of models possibly at higher costs rather than by reducing costs and price.⁵

6. Increasing the scale of production and thereby increasing profits does not necessarily reduce costs: "do high costs automatically disappear when profits are good? When all the facts are known, the plant that has high costs in periods of low operating profit has equally high costs, often higher, in prosperous times, with a given plant layout.....The sales price of a finished product normally influences the quality put into the product, but it does

not necessarily govern the amount of unwarranted or wasted labor, material, or operating expense incurred in factory operations. Such unwarranted waste is occasioned largely by the improper layout of the plant".⁶

Materials handling often accounts for a far greater proportion of costs than machining.⁷ Thus improving factory layouts may be far more effective in reducing costs than installing new machines.

Factory layout did not develop into a science until after 1910 with the development of industrial engineering and time study.⁸ This does not mean, however, that nobody thought before then of how to improve factory layouts. The new Raleigh factory, built in 1896, was organized on the so-called "progressive" principle.⁹ The idea was that the emerging product would travel through the plant in "a direct series of progressions", that is, one imagines, as far as possible in the same direction so as to reduce the total distance travelled, speed up production and reduce costs. The factory was bisected by a covered roadway so that materials could enter at one end and emerge at the other as the finished product. But this was less effective in practice because materials although moving in the one general direction, might zigzag across the central roadway from one side of the factory to the other. To judge from the diagram of this factory (fig. 14.2), it is very likely that the progression of materials might be anything but direct.

The new Rudge factory, built in 1906, was a six storey building.¹⁰ Although this factory enabled the firm to achieve a vastly greater output, the layout was far from ideal given that materials had to be transported between floors using slow-moving lifts. It was a better idea to layout the factory on one level.

In later years, factory layout gained increasing attention, but it was not until the period immediately before the war that motor cycle factories were being designed or reorganized so as to take full advantage of new ideas. Perhaps the first new factory to be designed with

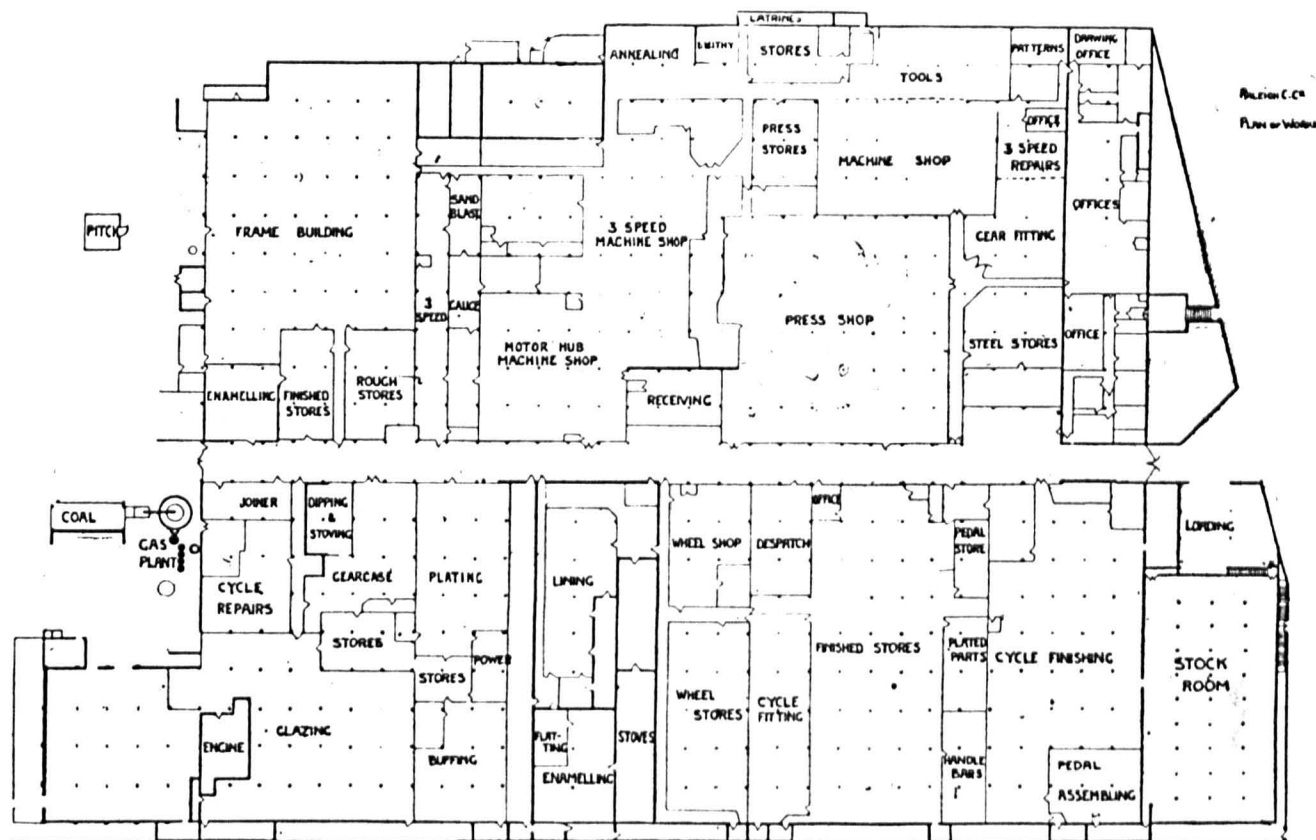


Fig. 14.2. Plan of the Raleigh Cycle Company's Works
at Nottingham
("The Motor-Cycle and Cycle Trader", 6 March 1914)

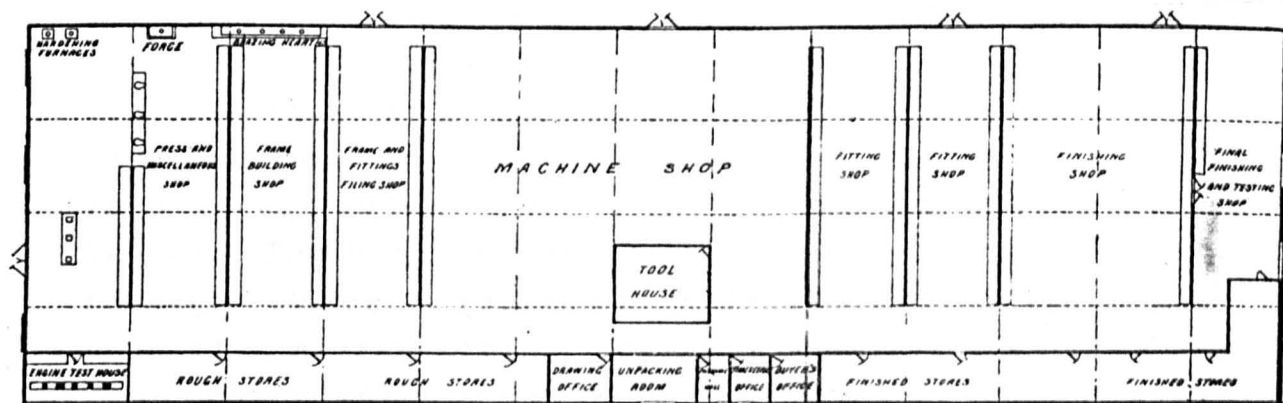


Fig. 14.3. Plan of the New A.J.S. Factory at Wolverhampton
("The Motor-Cycle and Cycle Trader", 30 July 1915)

reference to such considerations was built for AJS and completed about 1915. As can be seen from fig. 14.3 this was set out in linear fashion with the more basic operations such as frame building taking place at one end (left in the illustration), followed by the machine shop, fitting and finishing. This was the last major step in factory organization before the installation of line assembly, but that was still a long way off for the motor cycle industry.

7. There is little to say here about line assembly. In theory it was available to the motor cycle industry as soon as the idea was developed by Henry Ford and became generally known. It was probably not practicable, however, given the relatively small outputs being achieved even by the largest firms before the first world war. In 1928, BSA, possibly by then the largest motor cycle firm, considered line assembly impracticable because of the large number of different models (13) they produced.¹¹

Clearly then there were limits to what new production technology might achieve for the motor cycle industry before the first world war, either because output was too small, or because the new technology was developed too late. There was also the problem of attitudes and practices within the industry.

British industry was riddled with out-of-date attitudes and practices rooted in the craft technology of the past. In order to take advantage of the new machine technology it was necessary to do much more than simply install the new machines. New machinery meant higher output, faster operation and faster work-pace. The British were always reluctant to commit themselves to such methods which as a result often did not pay: "The American pace is faster. The work is organised to produce a faster flow-through. There is greater standardisation, to secure the economies of repetition. Factory discipline is tighter. Work study plays a larger role in setting production norms. In fact, starting from about the 1880s the Americans set out to study the economising of labour in factory operations; their factory is a more 'scientific' place than the

British".¹²

In contrast, the British tended to see industrial production more as an art than a science: "The Triumph Company, to-day, have more work in hand and awaiting their attention than they can undertake; they recognise that they cannot adequately deal with such a demand by running up new works, the element of skill and acquired art can only be extended slowly, and so we see the company turning away orders rather than, for an immediate profit, jeopardizing their name for good quality".¹³

Also, we may contrast this emphasis on "acquired art" in British industry with the thousands of engineers being trained at universities in others countries. In 1913 Britain had only nine thousand university students compared with almost sixty thousand in Germany: "Germany produced three thousand graduate engineers per year while in England and Wales only 350 graduated in all branches of science, technology and mathematics with first and second-class honours".¹⁴

Thus while it would appear that the motor cycle industry lacked sufficient skilled labour to expand production in the traditional way rapidly enough to absorb all the demand, firms were either reluctant or unable to make the fullest use of the new technology to increase production. It was considered more important to maintain the standard of quality than to increase output. When BSA started to manufacture complete bicycles in 1909, quality was emphasized and the price was raised deliberately to underline the fact: "In view of the somewhat altered conditions, it was considered advisable to manufacture a complete B.S.A. Bicycle, under the most rigid inspection, with the world famed B.S.A. Fittings. There would be one grade of machine—the highest quality only. The machine so offered to the public would be listed at a higher price than that at which bicycles built with B.S.A. Fittings had been sold by local agents and makers. The management believed that this would not only create a greater demand for B.S.A. productions, but that it would have a steadying effect on

the cycle trade generally".¹⁵ There were still some in the cycle industry even in 1916 who blamed the introduction of high-speed machinery for "overproduction" and "mediocrity" and called for attempts to improve quality by denying improvement of cheap machines.¹⁶

This was also the standard approach to motor cycle manufacture and for the most part those in the industry endorsed it. Otherwise it is likely that the industry could have achieved more economical operation and lower prices, thus perhaps stimulating sales significantly beyond the levels that were reached, and perhaps achieving even greater economies. But the whole idea of operating in this way was almost an anathema to the industry, a betrayal of everything it stood for: "Just as there is no cutting in the price, so there is no cutting in the quality and the product resulting is an honest bicycle at an honest price";¹⁷ "Quality is what the directors are aiming at";¹⁸ "The only true course to permanent popularity of success, is that of building up to a certain standard".¹⁹

NOTES

The key to source abbreviations will be found at the beginning of the Bibliography.

Chapter 1

1. Ryerson, 1980, p. 10.
2. Boston Consulting Group Ltd., 1975, p. 59.
3. Hopwood, 1981.
4. Ryerson, 1980, p. 158.
5. Ayton et al, 1979, p. 229.
6. E.g., in the widespread imitation of the Triumph, Ixion, 1975, p. 55.
7. See Note 1, Chapter 4.
8. Verman, 1973, p. 1.
9. The amount of material was very limited, nevertheless, and what is presented here was found only after an extensive search of the shelves of several libraries, and of long runs (up to thirty years) of several journals. The latter are listed as a separate block in the bibliography under the heading: "History Journals".
10. CR, 9 2 1889, p. 265-6.
11. Stone, 1904, p. 16.
12. Maclaughlin, 1954, p. 37.
13. Doyle, 1959, p. 10.
14. Thomas, 1969, p. 145.
15. Fearon, 1969, p. 481.
16. *ibid.*, p. 482.
17. *ibid.*, p. 484.
18. Mills, 1959, p. 128.

Chapter 2

1. E.g., Cady, 1946; Dickson, 1947; Dresser & Cooke, 1933; Econ, 13 8 1927, pp. 277-8; "The Engineer", 22 6 1951, p. 830; Fawcett, 1949; "Machinery", 11 2 1959, p. 291; Martin, 1971; "Nature", 24 1 1931, pp. 117-9; Robertson, 1916; Stabler, 1959, and most of those cited elsewhere in the chapter.

2. Lee, 1929, vol. 2, p. 838.

3. Balfour, 1927, p. 266.

4. Wyatt, 1917, pp. 99-100.

5. Gaillard, 1934, p. 33.

6. Melnitsky, 1953, p. 1.

7. Verman, 1973, pp. 14-5.

8. International Organization for Standardization, 1971, p. 5.

9. Verman, 1973, p. 1.

10. Huxley, 1974, p. 14.

11. Brady, 1927, p. 1.

12. Harriman, 1928, p. 1.

13. Verman, 1973, p. 2.

14. Brady, 1929, p. 9.

15. Perry, 1955, p. 6; Skinner, 1967, p. 4.

16. E.g., the Metric system is based on the metre—one forty millionth of a meridian.

17. Teubal, 1979, p. 276.

18. Mayall, 1979, p. 46.

19. This account is extremely simplified and is not intended to amount to a detailed history of bicycle frame development, but simply to raise some points of interest. The history of the bicycle is discussed in Chapter 5.

20. When subjected to a bending stress, most of the resistance in a beam is provided by the outer fibres while those at the centre, what is known as the "neutral axis", will be virtually unstressed. Thus a tube would have almost as much resistance to bending as a solid member while being much lighter. Sharp, 1896, p. 104.

Chapter 2 (cont.)

21. N.B. Three forces in equilibrium must all pass through the same point. Sharp, 1896, p. 312.

22. See CT, 27 3 08, p. 928.

23. Skinner, 1967, p. 2.

24. Lee, 1929, vol. 2, p. 838.

25. The body of a piece of type is defined sometimes as the metal between the shoulder and the feet of type, sometimes as "the size or thickness of type". Updike, 1937, p. 15.

26. Cited in *ibid.*, p. 29, from Fournier's "Manuel Typographique", Paris, 1764.

27. Updike, 1937, pp. 26-31.

28. Rosenberg, 1972, pp. 93-4.

29. Roll, 1968, p. 85.

30. *ibid.*, pp. 115, 238.

31. Roe, 1916, p. 5.

32. Gilbert, 1965, p. 2.

33. *ibid.*, p. 6.

34. Musson, 1980, p. 92.

35. Robertson, 1964, p. 194.

36. Cesari, 1970, p. 235.

37. *ibid.*, p. 71.

38. *ibid.*, pp. 42-3.

39. *ibid.*, p. 236.

40. *ibid.*, p. 240.

41. *ibid.*, pp. 241-8.

42. Musson, 1957-8, p. 125.

43. Roe, 1916, p. 102.

44. Saul, 1967, p. 115.

45. Floud, 1976, p. 56.

46. Harrison, 1969, p. 297.

47. Ford, 1922, p. 72.

48. Levitt, 1962. p. 58.

Chapter 3

1. Concise Oxford Dictionary, 1978.
2. Douglas et al, 1978, p. 1.
3. Rothberg, 1976, p. 3.
4. Gisser, 1972, p. 2.
5. Booz et al, 1968, p. 7.
6. Skinner, 1972, p. 1.
7. ibid, p. 2.
8. Kraushar, 1969, p. 1.
9. Wasson, 1969, p. 282.
10. Rodger, 1974, p. 114.
11. Crawford, 1977.
12. Little, 1979, p. 258; Madell, 1980.
13. Booz et al, 1968, p. 2.
14. Marquis, 1969, p. 24.
15. E.g., in the American drug market, post-patent imitations account for 25% of sales. Econ, 7 8 1982, p. 75.
16. Andrews, 1975, p. 88.
17. Layton, 1972, p. 60.
18. Root, 1972, p. 6.
19. Chamberlin, 1933, p. 56.
20. ibid.
21. Meikle, 1979, p. 14.
22. Teubal, 1979.
23. Development costs can be as much as ten times the cost of the original invention. Parker, 1974, p. 4.
24. Marquis, 1969.
25. Including Banting, 1978; Davidson, 1976; Layton, 1972; Rubenstein et al, 1976.
26. Cooper, 1975.
27. Cooper, 1979a; Cooper, 1979b; SPRU, 1972; Szakasits, 1974.
28. Rothwell, 1974b, p. 290; Calantone & Cooper, 1981, p. 59.
29. ibid.
30. ibid., p. 52.
31. ibid., p. 57.

Chapter 3 (cont.)

32. *ibid.*, p. 58.
33. *ibid.*, p. 59.
34. *ibid.*
35. Gisser, 1972, p. 2.
36. Howard, 1981,
37. Kassarian & Sheffet, 1971.
38. Davis, 1976.
39. Stafford, 1966.
40. Krugman, 1981.
41. Kamen & Toman, 1970.
42. Rogers & Shoemaker, 1971, p. 183; see also Rogers, 1962.
43. Uhl et al, 1970.
44. Rogers & Shoemaker, 1971, p. 184.
45. Bauer, 1968, p. 143-4; Ehrenberg, 1972, p. 259.
46. Roselius, 1971, p. 58.
47. Shapiro, 1968.
48. Shepard, 1967, p. 266.
49. Ostlund, 1974; Taylor, 1977. ,
50. Ostlund, 1974.

Chapter 4

1. The development of the product in the American automobile industry has been divided by Gaillard (1934), pp. 19-20, into three main phases: (1) the latent phase, which began with Cugnot's steam tractor of 1769 and ended with the practical application of the four-stroke principle in Otto's gas engine of 1876; (2) the development phase which is broken down into two stages, experimental, which is essentially pre-commercial, and the beginnings of industrial development covering the first commercial production; and (3) the standardization phase which began with the appointment of the first standardization committee.

Gaillard's scheme is interesting particularly as it is possibly the only attempt to analyse the development of an

Chapter 4 (cont.)

industry in its progress towards standardization. It is not altogether appropriate for present purposes, however, since standardization is defined differently and the phases are not related to the development of a standard product.

Chapter 5

1. Caunter, 1955, p. 1.
2. Palmer, 1958, p. 22.
3. Leighton, 1972, p. 62.
4. Palmer, 1958, p. 21.
5. Woodforde, 1970, p. 7.
6. Palmer, 1958, p. 8.
7. Woodforde, 1970, p. 9.
8. *ibid.*, p. 17.
9. Irving, 1946, p. 56.
10. Caunter, 1955, p. 8.
11. *ibid.*
12. Life and Inventions of James Starley, 1902, pp. 19-21; Woodforde, 1970, p. 23.
13. Caunter, 1955, p. 14.
14. Palmer, 1958, p. 61.
15. Whitt & Wilson, 1974, pp. 103-6.
16. Williamson, 1966, p. 53.
17. Hudson, 1960, p. 30.
18. Woodforde, 1970, p. 42.
19. Williamson, 1966, p. 54.
20. Sharp, 1896, p. 150.
21. Woodforde, 1970, p. 75.
22. Sharp, 1896, p. 166.
23. Grew, 1921, p. 18.
24. Woodforde, 1970, p. 78.
25. Grew, 1921, p. 21.
26. Woodforde, 1970, p. 67.
27. *ibid.*, pp. 94-5.
28. *ibid.*

Chapter 5 (cont.)

29. Sharp, 1896, p. 156.
30. Evans, 1978, p. 22.
31. CR, 9 2 1889, pp. 265-6.
32. Hudson, 1960, p. 35.
33. Woodforde, 1970, p. 92.
34. Harrison, 1969, p. 302.

Chapter 6

1. Ayton, 1979, p. 2.
2. Vanderveen, 1975, p. 4.
3. Ayton, 1979, pp. 3-4.
4. Caunter, 1982, p. 2.
5. *ibid.*
6. *ibid.*
7. Clarke, 1976, p. 177.
8. Hills, 1945, p. 1.
9. Williamson, 1966, p. 112
10. Usher, 1962, p. 407.
11. Bird, 1960, p. 25.
12. Usher, 1962, p. 407.
13. *ibid.*
14. *ibid.*
15. Ayton, 1979, p. 7.
16. *ibid.*, p. 10.
17. Beaumont, 1902, p. 63; Ixion, 1975, p. 15.
18. Ayton, 1979, p. 11.
19. *ibid.*, pp. 12-4.
20. Caunter, 1982, p. 5.
21. Ixion, 1975, p. 15.
22. Ayton, 1979, p. 10.
23. Caunter, 1982, p. 1.
24. Cummins, 1976, p. 4.

Chapter 6 Appendix

1. Concise Oxford Dictionary, 1976.
2. Aut, 17 4 1897, p. 251.
3. Aut, 4 12 1897. p. 774.
4. Wilson, 1900, p. 12.
5. C, 19 10 1898, pp. 1145-6.

Chapter 7

1. Ayton, 1979, p. 15.
2. *ibid.*
3. MCg, 28 2 1910, p. 413.
4. Duncan, 1926, p. 379.
5. Louis & Currie, 1977, p. 9.
6. Tragatsch, 1978, p. 162.

7. Much of the account which follows is based on "The World on Wheels" by H.O. Duncan, published by Duncan himself in 1926. Duncan was a professional racing cyclist in the 1880s before becoming involved in the industry towards the end of the decade. In 1894 he established a cycle business in Paris in partnership with Louis Suberbie. Duncan and Suberbie was the only firm outside Germany to manufacture the H & W motor bicycle, but the enterprise soon collapsed and Duncan went to work with Lawson as general manager of his British Motor Syndicate. In 1898 Duncan became managing director of de Dion-Bouton in France and remained in that position for most of the next twenty years. His book is thus one of the very few written by people who were intimately connected with the early motor and motor cycle industries.

8. Duncan, 1926, p. 672.
9. *ibid.*
10. *ibid.*, p. 793.
11. *ibid.*, p. 734.
12. Ixion, 1975, p. 16.
13. Duncan, 1926, p. 675.
14. *ibid.*, p. 733.

Chapter 7 (cont.)

15. *ibid.*, p. 734.

16. *Aut*, 10 12 1898.

17. These figures which have been derived mainly from data in Tragatsch (1978) should be taken as at best approximate since many firms were little known even at the time they were active and are no longer remembered. Nevertheless, they do give a fairly good idea of the size of the industry particularly for later periods. Most manufacturers had only one marque name although there were a few which had more than one. In the latter cases, where known, only one marque has been counted.

18. Walford, 1931, p. 40.

19. *C*, 4 12 1901, p. 894.

20. It is doubtful that the situation could have been quite as bad as claimed by Frank Bowden in his opening speech at the 1901 National Show, but it would not have been very much better: "So far as he could learn, not a single bonafide motor manufacturer in this country had yet been able to make a profit". *C*, 27 11 1901, p. 837.

21. *CT*, 23 11 1900, p. xxvii.

22. According to H.O. Duncan, at one time de Dion had 14,000 orders on their books. *Aut*, 18 3 1899, p. 209.

23. Walford, 1931, p. 34.

24. *CT*, 15 2 1907, p. 504.

25. Louis & Currie, 1977, p. 34.

26. *C*, 9 10 1901, p. 706.

27. A.J. Wilson, using a rather crude method—an assumed output of one machine per week for each of the fifty or so manufacturers in business at that time—suggested a possible annual output of 2,600. *Aut*, 6 1 1900, p. 5. Very likely he was not far wrong.

28. Ixion, 1975, p. 20. Firms of this nature do not figure in the statistics of the industry already discussed.

29. *Aut*, 6 11 1897, p. 711.

30. Sheldon, 1971, p. 24.

31. Caunter, 1982, p. 8.

Chapter 7 (cont.)

32. Aut, 1896, p. 574.
33. Walford, 1931, p. 19.
34. EM, 1 9 1899, p. 68.
35. CT, 8 9 1899, p. p. 464.
36. EM, 22 9 1899, p. 138 and 29 9 1899, pp. 160-161.
37. EM, 27 10 1899, p. 252.
38. EM, 10 6 1899, pp. 402-403. This comment came from a regular contributor who was involved in the motor industry as a car designer.
39. Aut, 1 12 1900, p. 1173.
40. C.R. Garrard, CT, 16 2 1900, p. 396.
41. Aut, 4 12 1897, p. 774.
42. C, 20 11 1901, p. 827.
43. Beaumont, 1902, p. 319.
44. Walford, 1931, p. 24.
45. Aut, 4 12 1897, p. 773.
46. Sandes, 1945, p. 166.
47. Aut, 21 7/1900, pp. 700-701.
48. Walford, 1931, p. 43.
49. MCg, 11 1 1916, pp. 261-262; 1 2 1916, pp. 329-330 and 8 2 1916, p. 366.
50. Ayton, 1979, p. 30.
51. Caunter, 1982, p. 15.
52. Those involved with motorcycling in the early years of the industry have been described thus: "Some of us were engineers.....Others gambled on its commercial possibilities. Others again, were adventurers, pure and simple".Ixion, 1920, p. 13.
53. MC, 30 3 1961, pp. 384-385.
54. Dincan, 1926, p. 720.
55. Ixion, 1927, p. 18.
56. ibid.
57. Ixion, 1920, p. 96.

Chapter 7 (cont.)

58. At the turn of the century there were more de Dion motor tricycles on the road, including those built under license, than all the other vehicles put together. Sheldon, 1971, p. 40.

59. Ixion, 1927, p. 90.
60. Aut, 21 1 1899, p. 65.
61. Aut, 5 4 1899, p. 300.
62. *ibid.*
63. Aut, 6 1 1900, pp. 5-6.
64. CT, 21 1 1900, p. 68.
65. Aut, 8 5 1897, p. 295.
66. Ixion, 1927, p. 55.
67. Aut, 12 8 1899, pp. 707-708.
68. Aut, 11 9 1897, p. 582.
69. MCg, 22 11 1910, p. 47.
70. Aut, 1 1 1898, p. 8.
71. *ibid.*
72. CT, 8 3 1901, p. 585.
73. C, 21 8 1901, p. 580.
74. Aut, 25 8 1900, p. 824.
75. *ibid.*
76. *ibid.*
77. Aut, 31 8 1901, p. 218.
78. Ixion, 1975, p. 26.
79. Aut, 21 7 1900, p. 700.
80. Aut, 2 3 1901, pp. 203-204.
81. Aut, 10 8 1901, p. 137.
82. MCW, 25 12 1982, p. 6.
83. Ixion, 1927, p. 32.
84. Ixion, 1920, p. 33.
85. CT, 16 2 1900, p. 393.
86. C, 7 8 1901, p. 548.
87. Duncan, 1926, p. 380.

Chapter 8

1. CT, 25 10 1901, pp. 219-20.
2. CN, 25 3 1902, p. 12.
3. MCg, 29 10 1902, p. 190.
4. MCg, 3 12 1902, p. 292.
5. MC, 24 7 1905.
6. CT, 9 1 1903, p. 67.
7. These figures are based on further analysis of Tragatsch's data, see Chapter 7, note 17, and involve a degree of approximation where dates are imprecise.
8. CT, 20 1 1905, p. 206.
9. E.g., Humber's profits mainly from car manufacture were £154,435 in 1906-7, but in 1907-8 they had to clear their stock at below cost and made a loss of £23,082. *Econ*, 28 11 1908, p. 1020.
10. MC, 6 12 1909, Supplement.
11. BCMCMTU, 1927, p. 15.
12. E.g., in 1906-7 the number of registrations was 8,142 (MC, 6 12 1909, Supplement) while production in 1907 was only 3,700 (Census of Production, 1907, p. 203). The excess of imports over exports was about 900 (BCMCMTU, *op.cit.*, p. 12).
13. MC, 6 12 1909, Supplement.
14. MC, 29 5 1905, pp. 465-6.
15. MC, 18 12 1905, p. 1078.
16. *ibid.*
17. MC, 23 10 1905, p. 920.
18. Sandes, 1945, p. 307.
19. MC, 26 6 1905, p. 570.
20. MCg, 12 3 1912, p. 511.
21. Oliver, 1971, p. 15.
22. Census of Production, 1907, p. 203.
23. MC, 20 11 1907, p. 913.
24. MC, 27 11 1907, p. 937.
25. MC, 6 12 1909, Supplement.
26. MC, 5 8 1903, pp. 424-6.
27. Cg, 7 12 1901, p. 187.

Chapter 8 (cont.)

28. Aut, 29 11 1902, p. 544.
29. CT, 4 12 1903, p. 764.
30. Aut, 6 11 1897, p. 711.
31. CT, 1 1 1904, p. 60.
32. MCW, 8 1 1983, p. 16.
33. Sheldon, 1961, p. 71; Talbot, 1920, p. 624.
34. MC, 27 2 1905, p. 197.
35. MC, 23 12 1903, p. 961.
36. MC, 20 11 1905, p. 1006.
37. MC, 18 12 1905, p. 1078.
38. MC, 4 12 1905, p. 1044.
39. MC, 25 12 1905, p. 1096.
40. MC, 5 12 1906, p. 2063. As in the previous year it was again BHD writing in "The Motor Cycle".
41. *ibid.*, p. 2065.
42. Letter from Rex Motor Manufacturing Co. to "The Motor Cycle", 22 1 1906, p. 1192.
43. MC, 9 4 1906, pp. 1398-1400.
44. MC, 11 12 1907, p. 989.
45. MC, 4 12 1904, p. 1203.
46. MC, 2 1 1907, p. 1.
47. MC, 2 2 1904, p. 108.
48. *ibid.*
49. *ibid.*
50. Aut, 11 8 1901, p. 138.
51. Aut, 22 2 1902, p. 202.
52. Aut, 12 10 1901, p. 365.
53. MC, 2 2 1904, p. 108; 17 10 1906, p. 1917.
54. *ibid.*
55. *ibid.*
56. delete
57. CT, 17 11 1905, p. 494.
58. *ibid.*, p. 498.
59. Ixion, 1975, p. 218.
60. Davies, 1980, pp. 11-2.

Chapter 8 (cont.)

61. E.g., £7,500 in 1899-1900, Econ, 8 12 1900, p. 1729.

62. Ayton et al, 1979, p. 39.

63. Ixion, 1920, p. 35.

64. MC, 10 7 1905, p. 603.

65. ibid., p. 605.

66. Ixion, 1975, p. 54.

67. ibid., p. 222.

68. ibid., p. 54.

69. ibid.

70. Louis & Currie, 1978, p. 7.

71. Econ, 16 11 1907, p. 1971; 28 11 1908, p. 1020; 14 12 1912, p. 1209.

72. Econ, 9 12 1911, p. 1202.

73. Battson, 1974, pp. 8-9.

74. ibid.

75. EM, 11 1 1901, p. 4.

76. Mot, 27 9 1904, p. 199.

77. Footboards never became a permanent feature of the standard motor bicycle, although they are probably more comfortable than any other kind of footrest.

78. "To extend the trend in motor bicycles to any great extent new purchasers must be recruited from the ranks of novices, whereas the earlier buyers were for the most part expert riders of the ordinary machine." CT, 13 1 1905, p. 105.

79. MC, 26 6 1907, p. 520.

80. MC, 10 7 1907, p. 558.

81. MCg, 23 4 1902, p. 171.

82. CT, 2 3 1905, p. 348.

83. Aut, 31 8 1901, p. 218.

84. Aut, 12 10 1901, p. 365.

85. ibid.

86. MC, 5 8 1903, p. 424.

87. ibid.

88. ibid.

Chapter 8 (cont.)

89. *ibid.*, p. 426.
90. *ibid.*
91. Sandes, 1926, p. 589.
92. MC, 9 4 1906, p. 1401.
93. MC, 22 1 1906, pp. 1180-1.
94. *ibid.*
95. MC, 14 8 1905, p. 717.
96. *ibid.*
97. *ibid.*
98. Letter from Ariel Cycle Co. in MC, 19 6 1905, p. 552.

99. There were various adverse press reports about the industry including one originating in a report of an American consul which claimed the industry was doomed because of "vibration and noise"(Aberdeen Daily Journal, 14 7 1905). MC, 29 5 1905, p. 465; 24 7 1905, p. 658; 15 1 1906, p. 1169.

100. The same point had been noted elsewhere: "In the same way, too sudden an advance, even if mutations for it were all available at one time, would often be nonadvantageous or even disadvantageous. We can see this from analogies with human constructions. In the evolution of the motor-car, the substitution of four for one or two cylinders was a great improvement: it had "survival-value". However, not until the majority of cars came to be four-cylindereed was the additional advantage of still more cylinders of sufficient appeal to give the six- or eight-cylindereed engine any considerable advantage in the market. Huxley, 1974, p. 499.

Chapter 9

1. CT, 17 3 1916, p. 422.
2. According to the Census of Production, 1913, total output in 1907 was 3,700. During that year Triumph

Chapter 9 (cont.)

produced 160 machines in their best month alone, CT, 11 8 1911, p. 312. Their total output has been put at not less than 1000, Louis & Currie, 1978, p. 7.

3. CT, 7 6 1912, p. 581.
4. MCg, 12 3 1912, p. 511.
5. CT, 17 3 1916, p. 422.
6. *ibid.*
7. Burgess & Clew, 1980, p. 19.
8. Ryerson, 1980, p. 24.
9. MC, 27 10 1910, p. 1026.
10. MC, 6 10 1910, p. 957.
11. Reynolds, 1977, pp. 27-34.
12. CT, 5 1 1912, p. 16.
13. CT, 1 12 1911, p. 702.
14. MCg, 12 3 1912, p. 586.
15. Champ, 1980, p. 26.
16. *ibid.*, p. 32.
17. Clew, 1981, p. 24.
18. CT, 17 3 1916, p. 422.
19. *ibid.*
20. MC, 4 8 1910, p. 732.
21. CT, 30 12 1910, p. 1770.
22. MCg, 19 11 1912, p. xxx.
23. MC, 25 9 1913, p. 1249.
24. James Cycle Co., 1947, p. 20.
25. MC, 15 12 1910, p. 1241.
26. Clew, 1974, p. 16.
27. *ibid.*, p. 20.
28. *ibid.*, p. 25.
29. *ibid.*, p. 27.
30. MC, 2 9 1908, pp. 682-683.
31. Ixion, 1975, pp. 72-3.
32. Clew, 1974, p. 48.
33. CT, 7 6 1912, p. 581.
34. Based on data in Tragatsch, 1978. The same comments apply here as in Chapter 7, note 17.

Chapter 9 (cont.)

35. CT, 18 4 1913, p. 174.
36. Society of Motor Manufacturers and Traders, 1935, p. 53.
37. Henry Sturmev calculated the industry's output in 1913 at 50,047. MCg, 6 1 1914, p. 314.
38. MCg, 5 9 1911, p. 457.
39. MC, 25 9 1913, p. 1249.
40. MCg, 19 3 1912, pp. 585-6; CT, 17 10 1913, p. 174.
41. MC, 10 11 1910. p. 1095.
42. John Pollitt papers, 8/401.
43. BCMCMTU, 1927, p. 15.
44. Calculated from figures in CT, 17 7 1914, p. 166.
45. MC, 6 1 1916, leading article.
46. MC, 20 8 1914, leading article.
47. AC, 18 3 1914, p. 420.
48. MCg, 27 5 1913, p. 67.
49. CT, 7 8 1914, p. 366.
50. Talbot, 1920, p. 628.
51. Davies, 1980, p. 25.
52. Clew, 1981, p. 50.
53. MC, 9 12 1915, p. 577.
54. Vanderveen, 1975, p. 26.
55. MC, 1 10 1914, p. 393.
56. CT, 17 9 1915, p. 363.
57. CT, 26 6 1915, p. 488.
58. CT, 23 7 1915, p. 131.
59. BCMCMTU, 1927, p. 15.
60. CT, 24 3 1916, p. 523.
61. MC, 8 7 1915, p. 29.
62. MC, 27 7 1916, pp. 70-1.

Chapter 10

1. MC, 2 12 1908, p. 944.
2. Ixion, 1975, p. 55.
3. MCg, 3 7 1912, p. 235.

Chapter 10 (cont.)

4. Leading article, MC, 27 8 1914.
5. CT, 5 1 1912, p. 16, 2 1 1914, p. 14.
6. CT, 25 12 1914, p. 530.
7. MC, 13 10 1909, p. 771.
8. Calculated from data in CT, 5 12 1913, p. 798.
9. MCg, 6 1 1914, p. vii.
10. Leading article, MC, 9 11 1916.
11. AC, 21 1 1914, p. 156.
12. Clew, 1981, p. 34.
13. MCg, 16 12 1913, p. xxiii.
14. MCg, 3 3 1914, p. 558.
15. Leading article, MC, p. 9 11 1916.
16. MC, 21 11 1912, pp. 1351-1358.
17. MC, 25 2 1915, pp. 190-192.
18. MC, 4 12 1913, p. 1025.
19. MC, 12 2 1908, pp. 115-119.
20. MC, 21 11 1912, pp. 1351-1361.
21. MC, 12 2 1908, p. 117 and 16 11 1911, p. 1232.
22. MCg, 19 3 1912, p. 584.
23. MCg, 18 11 1913, p. 57.
24. CT, 7 11 1913, p. 330.
25. CT, 28 3 1915, p. 362.
26. Percentages calculated from data in MC,
2 12 1908, p. 944 and CT, 5 12 1913, p. 798.
27. CT, 7 11 1913, p. 334.
28. MCg, 4 4 1910, p. 538.
29. AC, 19 11 1913, p. 753.
30. Hough & Setright, 1973, p. 38.

Chapter 11

1. MCg, 8 11 1910, p. 667.
2. MC, 24 6 1908, p. 492.
3. *ibid.*
4. MC, 28 7 1909, p. 572.
5. MC, 14 7 1910, p. 671.

Chapter 11 (cont.)

6. MC, 26 1 1911, p. 87.
7. MC. 17 11 1910, p. 1130.
8. MC, 18 5 1911, p. 498.
9. *ibid.*, p. 499.
10. MC, 25 5 1911, p. 512.
11. *ibid.*, p. 514.
12. MCg, 7 11 1911, p. 732.
13. *ibid.*, p. 734.
14. MCg, 21 11 1911, p. 105.
15. *ibid.*
16. MC, 21 4 1910, pp. 340.
17. MCg, 9 8 1910, pp. 331-332.
18. MCg, 25 7 1911, pp. 292.
19. *ibid.*, p. 294.
20. MC, 23 5 1912, p. 557.
21. AC, 25 2 1914, p. 333.
22. MC, 17 4 1913, p. 491.
23. CT, 22 5 1914, p. 504.
24. MCg, 17 2 1914, p. 480c.
25. MCg, 25 5 1915, p. 69.
26. MC, 2 4 1914, p. 412.
27. MCg, 8 11 1910, p. 668.
28. MC, 24 6 1908, p. 492.
29. AC, 16 4 1914, p. 584.
30. AC, 4 11 1914, p. 546.

Chapter 12

1. MC, 8 9 1909, p. 683.
2. Econ, 14 12 1912, p. 1209.
3. BCMCMTU, 1927, p. 15.
4. MC, 16 11 1911, p. 1228 and 21 11 1912, p. 1351.
5. BCMCMTU, 1927, p. 15.

Chapter 13

1. This is Tables 8.1 and 9.1 combined and the same notes apply, particularly Chapter 7, note 17.

2. Boston Consulting Group Ltd, 1975, p. 57.

Chapter 14

1. Cycle firms had been improving their production methods since the late 1890s, albeit sometimes reluctantly. Harrison, 1969.

2. Mallick & Gaudreau, 1960, pp. 23-4.

3. Works of the BSA Co. Ltd, 1928, p. 434.

4. CT, 21 1 1910, p. 278.

5. Price data for the whole industry dates from 1906, the year of the first buyers' guide published by "The Motor Cycle".

6. The 1902 Quadrant was priced at £50-55 depending on the size of the engine. C, 27 8 1902, ad. supp.

7. CT, 27 11 1908, p. 621.

8. CT, 22 10 1909, p. 203.

9. Calculated from data in "The Motor Cycle" buyers' guides, MC, 9 4 1906, 12 2 1908, 7 2 1910, 21 11 1912.

10. Econ, 22 11 1913, p. 1120.

11. Although these figures are not precise, it seems likely that this relationship between output and profit was near to being a constant. Triumph profits in 1908-9, and 1909-10, were £26,886 and £31,048, (Ec, 9 12 1911), while their annual output was about 3,000, (Louis & Currie, 1978, p. 7), which again suggests something like £10 profit per machine. However these figures might be manipulated it is hard to see how they could support the argument that Triumph was experiencing anything like economies of scale.

12. Boston, 1975, p. 15.

13. Mitchell, 1976, pp. 185 & 744.

14. CT, 22 9 1911, p. 680.

15. See Chapter 8, pp. 143 and 146.

Chapter 14 (cont.)

16. MCg, 24 1 1911, p. 309.

17. MC, 6 5 1908, Supp. p. 34.

18. After winning the team prize in the 1910 Scottish Six Days Trial, Douglas received many new orders and applications from dealers wanting an agency. Clew, 1981, p. 29.

19. Ryerson, 1980, p. 115.

20. Burgess & Clew, 1980, p. 23.

21. The recent failure of the Sinclair electric tricycle is a good illustration of this and typical of what happened in the motor cycle industry with equally radical innovations. Success might have eventually come to Sinclair but only if he had started with a relatively low output and persevered with the tricycle over a period long enough to enable the potential consumer to become sufficiently familiar with it to accept it as an established product. Advertising alone had no chance of achieving this.

22. Boston, 1975, pp. 57-58.

Chapter 14 Appendix

1. CT, 5 1 1898, p. 709.

2. CT, 20 1 1911, p. 266.

3. MCg, 30 11 1915, p. 112.

4. AC, 7 1 1914, p. 76.

5. Ryerson, 1980, pp. 42-3 & 115.

6. Mallick & Gaudreau, 1960, pp. 20-1.

7. *ibid.*, p. 27.

8. *ibid.*, pp. 23-4.

9. C, 29 4 1896, p. 404.

10. CT, 27 3 1914, p. 830.

11. The Works of the BSA Co. Ltd., 1928, pp. 434.

12. Lewis, 1978, p. 126.

13. CT, 21 1 1910, p. 278.

14. Hobsbawm, 1972, p. 182.

Chapter 14 Appendix (cont.)

15. CT, 17 3 1916, p.408.
16. ibid., p. 432.
17. Account of the Hazlewood works, CT, 23 2 1912, p.
482.
18. Account of NUT works, MCg, 5 5 1914, p. 872.
19. AC, 30 6 1915, p. 22.

BIBLIOGRAPHY

Journals, with abbreviations where used:

Aut	The Autocar
AC	The Autocycle
	The Bicycling Times
	Classic Bike
	The Classic Motor Cycle
Cg	Cycling
CR	The Cycle Record, Athletic Review and Diary
CT	The Cycle Trader, renamed: The Cycle and Motor Trader in April 1902 The Cycle and Motor Cycle Trader in June 1905 The Cycle and Motor Trader in January 1910 The Cycle Trader and Review in January 1911 The Cycle and Motor Cycle Trader and Review in October 1911 The Motor Cycle and Cycle Trader in January 1914
CN	(Manchester) Cyclers' News, renamed: Cyclers' News and Motor Cycle in March 1902
C	The Cyclist (and Bicycling and Tricycling Trades' Review)
Econ	The Economist
	The Engineer
EM	The English Mechanic (and World of Science) Machinery
MC	The Motor Cycle, renamed:
MCW	Motor Cycle Weekly in the 1960s
MCg	Motor Cycling, renamed:
Mot	The Motor in 1903 and recreated as
MCg	Motor Cycling in 1909
	Nature

Historical Journals

Australian Economic History Review
Business History
Business History Review
Economic History review
Explorations in Entrepreneurial History, renamed:
Explorations in Economic History
Journal of Economic History
Journal of Transport History

Other Periodicals and Directories

Automobile Club Exhibition (Cordingley's) Catalogue
The Motor Cycle Index
The Motor, Motor-Cycle and Cycle Trade Directory, 1905
The National Cycle Show Catalogue
The Stanley Show Catalogue
The Stock Exchange Year Book
The "Trader" Handbook and Diary

Archives

John Pollitt Papers, Palaeography Room, Senate House,
London University
Simms Papers, as above
Modern Records Centre Collection, University of Warwick
BSA Collection, Birmingham Public Library

Other abbreviations:

ed.	editor
J.	Journal
Rev.	Review

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